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DEPARTMENT OF THE INTERIOR

DOMINION OF CANADA.

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

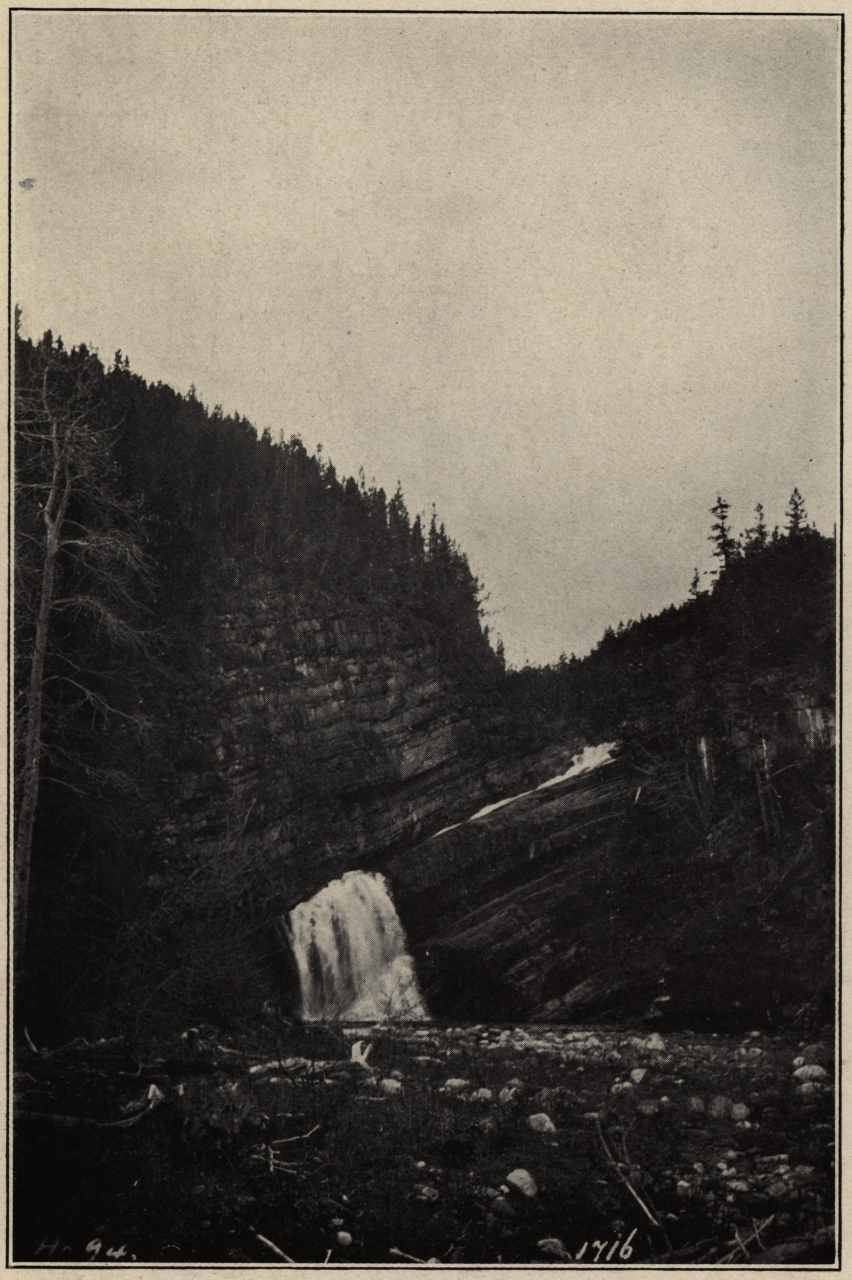
THE CALENDAR YEAR 1909

BY

P. M. SAUDER, C.E., Chief Hydrographer

PRINTED BY ORDER OF PARLIAMENT

OTTAWA
PRINTED BY C. H. PARMELEE, PRINTER TO THE KING'S MOST
EXCELLENT MAJESTY
1910



Cameron Falls on Oil Creek, near Waterton Lakes.

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To His Excellency the Right Honourable Sir Albert Henry George, Earl Grey, G.C.M.G., &c., &c., Governor General of Canada.

MAY IT PLEASE YOUR EXCELLENCY:—

The undersigned has the honour to lay before Your Excellency the report of the progress of Stream Measurements for the year 1909.

Respectfully submitted,

FRANK OLIVER,
Minister of the Interior.

OTTAWA, March 6, 1910.

DEPARTMENT OF THE INTERIOR,
OTTAWA, March 5, 1910.

The Honourable FRANK OLIVER,
Minister of the Interior.

SIR,—I have the honour to submit the report of Stream Measurements for the year 1909 and to recommend that it be published as the first of a series of progress reports.

I have the honour to be, Sir,
Your obedient servant,

W. W. CORY,
Deputy of the Minister of the Interior.

FORESTRY AND IRRIGATION BRANCH,
Department of the Interior,
OTTAWA, 4th March, 1910.

W. W. CORY, ESQ., C.M.G.,
Deputy Minister of the Interior.

SIR,—I beg to submit herewith the first progress report of Stream Measurements for the year 1909, submitted by Mr. P. M. Sauder, C.E., and would recommend that it be published and that a sufficient number of copies be printed to permit of its being widely distributed among those interested in the question of the water supply of Western Canada.

Respectfully submitted,

R. H. CAMPBELL,
Superintendent of Forestry and Irrigation.

DEPARTMENT OF THE INTERIOR,
Hydrographic Surveys,
CALGARY, Alta., Feb. 10, 1910.

SIR,—I beg to submit herewith reports of the Progress of Stream Measurements for the calendar year, 1909.

In submitting this report I realize that it would be more complete and possibly more interesting if a full report and discussion of the methods of obtaining and compiling the data contained therein were given, but owing to the importance of publishing the records at as early a date as possible this report is submitted as a progress report. It briefly outlines the organization and work of the survey and gives in a tabulated form the records of stream flow which have already been compiled. The work of the parties in the Milk River and Maple Creek Districts is dealt with in separate reports by F. H. Peters, C.E., and H. R. Carscallen, B.A. Sc., who had charge, respectively, of the field work in those districts. The original data for the reports of the Calgary and Macleod Districts were collected by H. C. Ritchie, J. C. Keith, A. W. Pae and myself. The assembling of the data and its preparation for the publication was done by A. W. Pae and myself. That portion of the data, shown in the report as obtained previous to 1909, was collected by the Irrigation Surveys under the direction of John Stewart, Commissioner of Irrigation.

I request that these reports be published as the first of a series of Reports of the Progress of Stream Measurements.

Respectfully submitted,

P. M. SAUDER,
Chief Hydrographer.

R. H. CAMPBELL, ESQ.,
Superintendent of Forestry and Irrigation,
Ottawa.

REPORT

ON THE

PROGRESS OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1909.

By P. M. Sauder, Chief Hydrographer.

Introduction.

One of the most important resources of a country is its water supply. In the arid and semi-arid regions, the limit of agricultural developments is determined to a considerable extent by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary, additional water supply for domestic and industrial uses, in procuring which both the quantity and quality that may be obtained must be considered. The notable advances made in electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The success of future irrigation development in Alberta and Saskatchewan depends to a large extent upon a correct estimate of the water supply available and the permanency of that supply. Frequently applications to purchase lands under the Irrigation regulations cannot be dealt with for a considerable time and sometimes not at all, owing to insufficient information as to the water supply. In dealing with projects which must depend entirely on high water and flood stages it is very important that both the quantity of water at those stages and the probable duration of those stages, should be known. Applications to divert water from streams upon which the Department has made no investigations, are often received and cannot be dealt with until an estimate of the water supply can be made. This often discourages investors, who naturally feel that they must depend on the Government for the information as to water supply and do not care to invest money in a project depending almost entirely on a resource of which so little is known. Reliable information can only be obtained by years of systematic observations, and private enterprise cannot be expected to do this.

The flow of a stream varies greatly from year to year, and yet the engineer is often expected to make estimates and prepare plans from observations extending over a short period. Systematic observations should be carried on over a period of several years to determine the general behavior of a stream. Many failures of large power, irrigation and other projects have been due to the fact that the plans were made without sufficient information regarding the water supply.

On the information furnished by the Government on the water supply, will depend to a very great extent, the development of water power in Canada. It only takes a short time to locate a good power site and determine the amount of power which can be developed when the water supply is known. Very often the hydraulic engineer has to spend a year or more in making observations of the discharge of a stream before he can make an estimate of the water power and in many cases it has been found that the possible water power development has been much over-estimated and in other cases much under-estimated.

Many problems in connection with municipal water supply, stock watering, mining, sewage disposal, navigation, etc., are readily solved when definite information on the water supply is available. In the United States, where stream measurements have been carried on systematically for several years, interested parties need only apply to the Government to obtain full information on the flow of almost any river.

The records of stream flow published by the Irrigation Surveys give a fair approximation of the discharge of the principal streams in Southern Alberta and Saskatchawan at the different stages, but do not give the duration of the periods of high and flood discharge. As the water supply in some of the larger streams is apparently almost all recorded, the necessity of carrying on a systematic observance of daily discharge is evident.

The chief features of the hydrographic work are the collection of data relating to the flow of the surface waters and the conditions affecting this flow. Information is also collected concerning the river profiles, duration and magnitude of floods, water power, etc., which may be of use in hydrographic studies.

ORGANIZATION AND SCOPE OF WORK.

These investigations became a distinct feature of this Department in the spring of 1909, when a separate survey was organized, with headquarters at Calgary. The first specific appropriation for hydrographic work was made by Parliament during the session of 1908, an appropriation of $10,000 being made for gauging streams and determining the water supply in Southern Alberta and Saskatchewan. As this vote was not available until the season was too far advanced to organize and equip parties for field work in 1908, only a part of it was used in purchasing instruments and equipment for the parties which were sent out early in 1909. A further appropriation of $10,000 was made to carry on the work for 1909.

In organizing the Hydrographic Surveys it was realized that with the funds available, it would be impossible to make complete investigations of the whole of the water supply in the irrigation tract, but an effort was made to include all the more important streams. Gauging stations had already been established, by the Irrigation Surveys, on a number of the more important streams, and it was important that the observations at these should be continued without interruption. There were, however, many streams of considerable importance upon which there were no gauging stations, It therefore became the policy of the survey to continue the investigations at the stations already established and to establish other stations as soon as possible.

It was decided to place three parties in the field and the irrigation tract was divided into three districts, viz.—Calgary, Macleod and Maple Creek. The outlines of these districts are not definitely defined but each comprises as much of the surrounding district as could be included by one party working from the city or town of the same name.

In each district there was one hydrographer and an assistant, H. R. Carscallen, and H. C. Ritchie were placed in charge of the Maple Creek and Macleod districts, respectively, while I took personal charge of the work in the Calgary district, excepting during the months of July, August, and September when I was engaged in other duties and J. C. Keith was in charge. At the end of September Mr. Ritchie left to resume his studies at the University of Toronto and A. W. Pae was engaged to complete the season's work in the Macleod District and has been retained to complete the computations.

Each party was equipped with a team and light wagon and the necesssary gauging and surveying instruments. It was aimed to supply each hydrographer with sufficient equipment for the proper execution of his work but at the same time to keep the outfit as light as possible, so that the least possible time would be spent in travellng. For this reason no camp equipment was furnished except in the case of the Maple Creek District, where in some localities, accommodation could not be secured. In this respect the residents in the different districts have assisted the work very materially by giving accommodation to the field parties.

With the funds availahle, from the appropriation for "An Enquiry into Water Rights on St. Mary and Milk Rivers" an extra party was organized and commenced work in the field on July 1st, 1909. This party with F. H. Peters, C.E., in charge, devoted its energies more

particularly to a study of the flow of Milk River and the establishing of gauging stations on that stream, A report of the work of this party is given in detail by Mr. Peters, whose report is appended hereto.

The work of the different hydrographers and assistants during the past season has been very satisfactory and the interest they have taken in the work has been most gratifying. Considering the territory that had to be covered and the limited assistance and equipment at their disposal the amount of data that was collected is surprising.

While every effort was made to establish regular gauging stations on all the more important streams at as early a date as possible, it was impossible to accomplish this on many streams until the season was somewhat advanced. In the early part of the season, owing to numerous fluctuations in the flow, frequent discharge measurements had to be made at the gauging stations already established. After July the flow in the streams was lower and more regular and the hydrographers spent much more time in locating and establishing new gauging stations. In some cases, considerable time had to be spent in reconnaissance to locate the most suitable site for the gauging station.

With the data collected during the past season, some very valuable records of discharge and run-off have been compiled, and in a number of cases these records cover almost the whole of the open season. In some cases, for higher stages, there were scarcely sufficient data for complete records, but with few exceptions the computations are considered to be a very close estimate of the actual flow.

As the survey did not have a rating station, the manufacturers of the meters were asked to have them specially rated before being shipped. This they claimed had been done, but for some reason the rating tables were never furnished, although repeated efforts were made to secure them. The season was far advanced before it was definitely known that they would not be furnished and it was impossible to establish a rating station at that late date, so the general rating table for each particular type of meter had to be used. All meters should be tested from time to time but, except as the result of accidents, it is very improbable that they will differ by any appreciable amount from the standard rating table while new and in good condition. A close watch of each meter and comparisons with other meters did not reveal any defects in any of the new meters. Arrangements are being made for the establishment of a rating station at Calgary, at as early a date as possible and in future the meters used by the survey will be tested and rated regularly.

While the records in this report show the regimen and behaviour of the different streams during the past season and in several cases during part of the season of 1908, it must not be considered that sufficient information has been obtained and that the work at these stations may be discontinued. The precipitation and hence the flow of the streams or the run-off may be very different next season. A study of the general behaviour of the streams should extend over a period of several years.

There are still a number of important streams upon which gauging stations should be established. Many of the streams upon which there is only one gauging station at present are so affected by diversions of water for irrigation and other purposes that gauging stations should be established at two or more points along their course.

Recently there has been a number of applications from parties interested in power projects, for information regarding the flow in certain streams, and no doubt such applications will be more numerous in the near future. On streams where power is likely to be developed, special attention should be given to the low water flow, which in most cases occurs during the winter. For this reason it is very important that stream measurements should be continued during the winter on a number of the more important streams.

EXPLANATION AND USE OF DATA.

The volume of water flowing in a stream is known as run-off. In expressing it various units are used, depending upon the kind of work for which the data are needed. Those used in this report are "second-feet", "acre-feet", "run-off per square mile" and "run-off in depth in inches" and may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the body of water flowing in a stream one foot wide and one foot deep at the rate of one foot per second.

The "acre-foot" is the unit of capacity used in connection with storage for irrigation work, and is equivalent to 43,560 cubic feet. It is the quantity required to cover an acre to a depth of one foot.

The expression "second-feet per square mile" means the average number of cubic feet of water flowing each second from every square mile of drainage area on the assumption that the run-off is uniformly distributed.

"Depth in inches" means the depth of water in inches that would have covered the drainage area, uniformly distributed, if all the water could have accumulated on the surface. This quantity is used for comparing run-off with rainfall, which quantity is usually given in depth in inches.

It should be noticed that "acre-feet and depth in inches" represent the actual quantities of water which are produced during the periods in question while "second-feet" on the contrary, is merely a rate of flow per second.

The data obtained during the past two seasons and the estimates made therefrom have been compiled in tabulated form and for each regular gauging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Daily gauge height and discharge table.
4. Table of monthly discharges and run-off.

The description of stations gives such general information about the locality and equipment as would enable the reader to find and use the station. It also gives, as far as possible, a complete history of all the changes that have occurred since the station was established and that might affect the records in any way.

The list of discharge measurements gives the results of all the discharge measurements that have been made at or in the vicinity of the gauging station or have been used in completing the records for the gauging station. The table gives the date on which the measurement was made, the name of the hydrographer, the width and area of cross-section, the gauge height, and the discharge in second feet.

The table of daily gauge heights and discharges given in this report is a combination of two tables kept in the office of the survey, namely the table of daily gauge heights and the table of daily discharges. The table of daily gauge heights gives the daily fluctuations of the surface of the stream as reported by the observer. The gauge height given in the table represents the elevation of the surface of the water above the zero of the gauge. During high water, two observations of the gauge were made at some stations and the gauge height given in the table is the mean of the observations for the day. The discharge measurements and gauge heights are the base data from which the other tables are computed. The table of daily discharges is the discharge in second feet, corresponding to the stage of the stream, as given by the gauge heights.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gauge height was highest. As the gauge height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge greater than given in this column. Likewise, in the column "Minimum" the quantity given is the mean flow for the day when the mean gauge height was lowest. The column headed "Mean" is the average flow for each second during the month. The computations of the quantities in the remaining columns have been based upon this mean. The accuracy of the data in these columns depends upon a correct estimate of the drainage area. The drainage area for each gauging station was marked off on the sectional maps of the Department and the area taken off with a planimeter. In many districts, information regarding topographical features is very incomplete and the computed areas are only approximate. As the surveys of the Department are extended and completed these computations will be checked and, if necessary, corrected.

Bow River at Calgary, Alta.

This station was established May 5th, 1908, by P. M. Sauder. It is located at the Cushing traffic bridge on the north side of section 12, Tp. 24, Range 1, west of the 5th Mer. It is below the mouths of Elbow river and Nose creek and the intake of The Canadian Pacific Railway Company's canal.

At ordinary stages the stream is divided into two channels by the first pier from the right bank and in high water and flood stages, it is divided into three channels by the piers. The right bank is high and does not overflow, but some years ago the flat on the east side was submerged for a short period during an excessive flood. In recent years a dyke was built along the left bank to confine the stream within its banks at all stages. The bed and banks of the stream are liable to shift during high water and flood stages of the stream. The channel is straight for 300 feet above the station; above this there is a gravel bar, around which the stream shifts from time to time. The channel is straight to a point about 400 feet below the station, beyond which it gradually turns toward the left.

Discharge measurements are made from the bridge at all stages. The initial point for soundings is the west side of the left abutment. The distances are marked at every five feet, on the bottom cord of the downstream side of the bridge.

The gauge which is of the standard chain type was read daily by James Millen, who lives about 200 yards from the west end of the bridge. The length of the chain is 20.30 feet. The gauge is referred to a bench mark on the first pier from the left bank; elevation .9.91.

Discharge Measurements of Bow River at Calgary, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
April 29	P. M. Sauder	192·5	730	2·73	3·35	1,996
May 11	....do	210·0	1,059	4·72	5·00	4,994
Mag 16	H. R. Carscallen	218·0	1,160	5·22	5·38	6,053
June 3	P. M. Sauder	298·6	1,893	6·92	8·03	13,099
July 20	H. R. Carscalle.n	287·9	2,234	4·82	6·99	10,779
September 1	....do	211·5	1,607	2·56	4·50	4,109
October 9	P. M. Sauder	201·5	1,404	1·63	3·52	2,284
1909.						
April 23	P. M. Sauder	174·0	1,169	1·07	2·69	1,248
May 21	....do	205·5	1,472	2·52	3·98	3,713
June 7	....do	284·5	2,244	5·71	7·05	12,807
June 26	J. C. Keith	274·0	2,159	5·21	6·73	11,242
June 30	....do	277·5	2,074	4·91	6·43	10,179
July 7	....do	334·2	2,863	7·67	8·99	21,952
July 16	....do	278·5	2,095	4·90	6·46	10,272
August 6	....do	228·5	1,821	3·85	5·46	7,019
August 26	....do	209·0	1·564	2·71	4·40	4,252
September 17	....do	203·5	1,425	2·18	3·785	3,014
October 26	P. M. Sauder	196·5	1,306	1·50	3·30	1,958

Daily Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1908.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	6·70	9,090	6·70	9,490	5·50	6,400	4·60	4,300	3·80	2,790
2	.....	.....	8·95	16,325	6·60	9,210	5·60	6,660	4·40	3,900	3·80	2,790
3	.....	.....	8·25	13,820	7·20	11,070	5·50	6,400	4·30	3,700	3·80	2,790
4	.....	.....	8·45	14,550	7·70	12,720	5·50	6,400	4·30	3,700	3·80	2,790
5	.....	.....	9·50	18,450	7·50	12,090	5·30	5,900	4·30	3,700	3·80	2,790
6	.....	.....	9·60	18,880	7·00	10,500	5·30	5,900	4·30	3,700	3·70	2,620
7	.....	.....	9·45	18,330	7·00	10,520	5·30	5,900	4·20	3,510	3·70	2,620
8	.....	.....	9·20	17,390	7·00	10,540	5·40	6,150	4·20	3,510	3·70	2,620
9	.....	.....	8·90	16,280	6·90	10,260	5·30	5,900	4·20	3,510	3·60	2,450
10	5·00	4,990	9·50	18,570	7·60	12,530	5·30	5,900	4·20	3,510	3·40	2,110
11	5·00	4,990	9·10	17,080	7·60	12,550	5·30	5,900	4·20	3,510	3·40	2,110
12	5·10	5,200	9·00	16,740	7·50	12,230	5·30	5,900	4·20	3,510	3·40	2,110
13	5·30	5,640	8·80	15,990	7·50	12,250	5·30	5,900	4·10	3,330	3·40	2,110
14	5·30	5,640	8·20	13,890	7·50	12,270	5·20	5,650	4·20	3,510	3·40	2,110
15	5·35	5,750	7·90	12,800	7·50	12,290	5·00	5,160	4·30	3,700	3·40	2,110
16	5·40	5,860	8·00	13,160	7·50	12,310	4·90	4,930	4·30	3,700	3·40	2,110
17	5·75	6,660	8·30	14,300	7·50	12,330	4·90	4,930	4·30	3,700	3·40	2,110
18	5·65	6,425	7·80	12,660	7·40	12,030	4·90	4,930	4·50	4,100	3·30	1,940
19	5·55	6,195	7·40	11,430	7·30	11,720	4·90	4,930	4·50	4,100	3·40	2,110
20	5·50	6,080	7·40	11,460	7·00	10,780	4·90	4,930	4.40	3,900	3·50	2,280
21	5·45	5,970	7·20	10,860	6·90	10,470	4·90	4,930	4·30	3,700	3·30	1,940
22	5·30	5,640	7·00	10,260	6·90	10,470	4·90	4,930	4·20	3,510	3·30	1,940
23	5·30	5,640	6·70	9,430	6·70	9,850	4·90	4,930	4·20	3,510	3·30	1,940
24	5·20	5,420	6·50	8,890	6·70	9,850	4·90	4,930	4·20	3,510	3·30	1,940
25	5·30	5,640	6·70	9,450	6·70	9,850	5·10	5,400	4·20	3,510	3·40	2,110
26	5·50	6,080	7·60	12,180	6·50	9,240	5·10	5,400	4·20	3,510	3·40	2,110
27	5·50	6,080	8·10	13,960	6·30	8,640	5·10	5,400	4·20	3,510	3·40	2,110
28	5·50	6,080	7·60	12,300	6·20	8,340	4·80	4,710	3·90	2,970	3·40	2,110
29	5·50	6,080	7·30	11,320	6·00	7,760	4·80	4,710	3·90	2,970	.....	.....
30	5·60	6,310	6·70	9,470	5·90	7,480	4·70	4,500	3·80	2,790	.....	.....
31	5·90	7,020	.....	.....	5·50	6,400	4·60	4,300	.....	.....	.....	.....

DAILY Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2·70	1,280	6·60	11,100	6·70	11,130
2	.....	.....	2·90	1,620	7·60	15,230	6·90	11,910
3	.....	.....	3·30	2,370	8·60	20,220	7·00	12,330
4	.....	.....	3·70	3,130	8·30	18,660	7·30	13,610
5	.....	.....	3·00	1,800	7·90	16,670	7·50	14,480
6	.....	.....	2·90	1,620	7·60	15,230	7·50	14,480
7	.....	.....	2.80	1,440	7·00	12,600	9·00	22,020
8	.....	.....	2·80	1,440	6·60	10,971	8·90	21,490
9	.....	.....	2·70	1,280	6·30	9,884	8·50	19,380
10	.....	.....	2·80	1,440	6·30	9,873	8·30	18,340
11	.....	.....	3·30	2,370	6·60	10,936	7·80	15,860
12	.....	.....	3·10	1,990	7·50	14,684	7·60	14,940
13	.....	.....	3·50	2,750	7·80	16,054	7·30	13,610
14	.....	.....	3·50	2,750	8·20	18,024	7·10	12,750
15	.....	.....	3·70	3,130	8·10	17,504	6·70	11,130
16	.....	.....	3·50	2,750	8·00	16,988	6·50	10,400
17	.....	.....	3·30	2,370	8·20	17,974	6·50	10,400
18	.....	.....	3·30	2,370	8·30	18,470	6·40	10,040
19	.....	.....	3·70	3,130	8·20	17,941	6·20	9,360
20	2·70	1,280	4·00	3,760	8·20	17,925	6·00	8,690
21	2·70	1,280	4·00	3,760	8·00	16,910	5·80	8,040
22	2·70	1,280	4·20	4,200	7·90	16,391	5·80	8,040
23	2·70	1,280	4·30	4,430	7·70	15,441	5·70	7,740
24	2·70	1,280	4·80	5,640	7·10	12,776	5·80	8,040
25	2·80	1,440	5·50	7,520	6·90	11,922	5·90	8,360
26	2·80	1,440	5.90	8,740	6·80	11,510	6·00	8,690
27	2.80	1,440	5.70	8,120	6.50	10,400	6.80	11,510
28	2·90	1,620	6·00	9,050	6·50	10,400	6·70	11,130
29	2·70	1,280	6·20	9,700	6·50	10,400	6·30	9,700
30	2·70	1,280	6·30	10,040	6·40	10,040	6·10	9,020
31	.....	.....	6,20	9,700	.....	.....	6·00	8,690

DAILY Gauge Height and Discharge of Bow River, at Calgary, Alta., for 1908–9.—*Con.*

Day.	August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	5·90	8,360	4·40	4,290	3·60	2,640	3·20	1,880
2	5·80	8,040	4·30	4,070	3·70	2,830	3·20	1,880
3	5·70	7,740	4·30	4,070	3·70	2,830	3·20	1,880
4	5·70	7,740	4·30	4,070	3·80	3,020	3·20	1,880
5	5·60	7,440	4·40	4,290	3·70	2,830	3·20	1,880
6	5·40	6,850	4·40	4,290	3·70	2,830	3·20	1,880
7	5·30	6,570	4·40	4,290	3·60	2,640	.....	.....
8	5·10	6,010	4·40	4,290	3·60	2,640	.....	.....
9	5·00	5,730	4·30	4,070	3·60	2,640	.....	.....
10	5·00	5,730	4·30	4,070	3·50	2,450	.....	.....
11	4·90	5,470	4·30	4,070	3·50	2,450	.....	.....
12	4·90	5,470	4·30	4,070	3·60	2,640	.....	.....
13	4·80	5,220	4·20	3,850	3·60	2,640	.....	.....
14	4·80	5,220	4·10	3,630	3·50	2,450	.....	.....
15	4·80	5,220	4·00	3,410	3·50	2,450	.....	.....
16	4·80	5,220	3·90	3,210	3·50	2,450	.....	.....
17	4·70	4,980	3·80	3,020	3·40	2,260	.....	.....
18	4·70	4,980	3·90	3,210	3·40	2,260	.....	.....
19	4·70	4,980	3·90	3,210	3·40	2,260	.....	.....
20	4·70	4,980	3·90	3,210	3·40	2,260	.....	.....
21	4·70	4,980	3·90	3,210	3·40	2,260	.....	.....
22	4·70	4,980	3·80	3,020	3·40	2,260	.....	.....
23	4·70	4,980	3·80	3,020	3·30	2,070	.....	.....
24	4·70	4,980	3,70	2,830	3·30	2,070	.....	.....
25	4·60	4,740	3·60	2,640	3·30	2,070	.....	.....
26	4·40	4,290	3·60	2,640	3·30	2,070	.....	.....
27	4·50	4,510	3·60	2,640	3·20	1,880	.....	.....
28	4·60	4,740	3·60	2,640	3·20	1,880	.....	.....
29	4·50	4,510	3·50	2,450	3·20	1,880	.....	.....
30	4·40	4,290	3·50	2,450	3·20	1,880	.....	.....
31	4·40	4,290	.....	.....	3·20	1,880	.....	.....

MONTHLY Discharge of Bow River at Calgary, Alta., for 1908-1909.

[Drainage area, 3,828 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage area	Total in acre-feet.
1908.						
May (10-31)	7,093	5,063	5,954·9	1·556	1·273	259,850
June	18,880	9,050	13,701·5	3·579	3·993	815,290
July	13,134	6,631	10,801·1	2·822	3·253	664,167
August	6,873	4,496	5,652·2	1·476	1·702	347,536
September	4,496	2,904	3,648·2	0·953	1·063	217,084
October (1-28)	2,904	1,940	2,400·2	0·627	0·653	133,300
The period	.....	.....	.....	.....	.....	2,437,227
1909.						
April (20-30)	1,620	1,280	1,354·5	0·354	0·145	29,553
May	10,126	1,280	4,176·2	1·091	1·258	256,784
June	20,306	10,069	14,527·4	3·795	4·234	864,444
July	22,051	8,060	12,263·2	3·204	3·694	754,018
August	8,680	4,314	5,878·9	1·536	1·771	361,482
September	4,758	2,490	3,703·0	0·967	1·084	220,343
October	3,106	1,880	2,422·9	0.633	0·729	148,977
November (1-6)	1,880	1,880	1,880·0	0·491	0·109	22,373
The period	.....	.....	.....	.....	.....	2,657,974

NOTE.—The discharges of the Canadian Pacific Railway Company's canal have been added to those of Bow River at Cushing Bridge, in this table.

CANADIAN PACIFIC RAILWAY COMPANY'S CANAL NEAR CALGARY, ALTA.

This station was established May 9, 1908, bv P. M. Sauder. It is about four miles from the intake, at the bridge (No. 2) on the road allowance on the east side of section 36, Tp. 23, Range 1 west of the 5th Meridian.

A plain staff gauge, graduated to feet and hundredths, is fastened to a pile on the upstream side of the bridge. Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inside of the first plank of the floor on the north end of the bridge. The right bank of the ditch is composed of a mixture of clay and gravel, while the bottom and left bank are composed of clay only. The bottom of the ditch is below grade at this point. The canal carries water only during irrigating season. There are no laterals from the ditch above the gauging station. The gauge was read once each day by J. E. Black, ditch rider for the company.

DISCHARGE Measurements of Canadian Pacific Railway Company's Canal near Calgary, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
May 12	H. R. Carscallen	49·5	84	0·74	2·19	63
July 22	....do	46·5	60	0·27	1·625	16
September 2	....do	46·5	62	0·26	1·64	15·8
October 1	H. C. Ritchie	52·0	103	0·95	2·45	98
1909.						
June 11	P. M. Sauder	51·5	111	1·27	2·47	141
June 25	J. C. Keith	45·0	62	0·36	1·47	22
July 3	....do	48·0	84	0·82	1·975	69
July 17	....do	50·0	97	0·98	2·20	96
August 6	....do	56·0	159	1·89	3·40	301
August 30	....do	56·5	165	1·92	3·48	318
September 18	....do	55·5	175	1·94	3·70	341

DAILY Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1908.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*
1	.....	.....	2·30	86	4·00	376	3·10	213	3·00	196	2·50	114
2	.....	.....	2·30	86	4·10	395	3·10	213	1·70	23	1·40	5
3	.....	.....	1·40	5	4·20	414	3·10	213	1·60	16	2·50	114
4	.....	.....	1·10	0	4·20	414	3·10	213	1·60	16	2·50	114
5	.....	.....	0·90	0	4·20	414	3·10	213	1·60	16	2·50	114
6	.....	.....	0·90	0	4·10	395	3·10	213	2·60	129	1·40	5
7	.....	.....	0·90	0	4·10	395	3·10	213	2·60	129	1·00	0
8	2·50	114	0·90	0	4·10	395	3·10	213	2·70	144	2·50	114
9	2·50	114	0·90	0	4·10	395	3·10	213	2·40	100	3·60	302
10	2·20	73	0·90	0	2·90	178	3·10	213	1·50	10	3·40	266
11	2·20	73	0·90	0	1·70	23	3·10	213	1·50	10	3·40	266
12	2·20	73	0·80	0	1·40	5	3·10	213	1·80	31	3·40	266
13	2·20	73	0·80	0	1·40	5	3·10	213	1·90	40	3·40	266
14	2·20	73	0·90	0	1·30	2	3·10	213	2·10	61	3·40	266
15	2·20	73	0·90	0	1·20	1	3·10	213	2·80	161	3·50	284
16	2·20	73	0·90	0	1·20	1	3·10	213	2·00	50	3·60	302
17	2·20	73	0·90	0	1·10	0	3·10	213	1·40	5	3·60	302
18	2·20	73	0·90	0	1·10	0	3·10	213	1·00	0	3·60	302
19	2·20	73	0·90	0	2·60	129	3·00	196	1·50	10	2·50	114
20	2·30	86	0·90	0	2·60	129	3·00	196	1·40	5	1·50	10
21	2·20	73	0·90	0	2·60	129	3·00	196	1·60	16	1·50	10
22	2·20	73	0·90	0	2·20	73	2·90	178	1·60	16	1·00	0
23	2·20	73	2·20	73	3·90	357	3·00	196	1·80	31	0·90	0
24	2·20	73	2·80	161	3·90	357	3·00	196	1·80	31	0·80	0
25	2·20	73	2·90	178	3·90	357	3·10	213	1·90	40	0·80	0
26	2·20	73	3·00	196	3·40	266	3·10	213	2·50	114	0·80	0
27	2·20	73	3·00	196	3·30	248	3·00	196	2·50	114	0·80	0
28	2·20	73	3·00	196	3·30	248	3·00	196	2·50	114	0·80	0
29	2·20	73	3·00	196	3·20	231	3·00	196	2·50	114	0·80	0
30	2·20	73	3·90	357	3·20	231	3·00	196	2·50	114	0·80	0
31	2·20	73	.....	.....	3·20	231	3·00	196	.....	.....	0·80	0

DAILY Gauge Height and Discharge of Canadian Pacific Railway Company's Canal near Calgary, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*
1.....	.....	.....	2·10	86	2·00	73	3·50	320	1·50	24	3·20	266
2.....	.....	.....	2·10	86	2·00	73	3·50	320	3·50	320	3·20	266
3.....	0·00	00	2·10	86	1·50	24	3·50	320	3·50	320	3·20	266
4.....	1·80	50	2·10	86	1·50	24	3·40	302	4·10	430	2·10	86
5.....	1·90	61	2·10	86	1·40	17	3·40	302	4·30	468	2·10	86
6.....	2·70	179	2·10	86	1·30	12	3·40	302	4·10	430	2·10	86
7.....	2·70	179	2·10	86	1·60	31	3·40	302	1·90	61	2·10	86
8.....	2·80	196	2·70	179	1·90	61	3·40	302	1·10	3	2·10	86
9.....	2·80	196	2·80	196	1·90	61	3·50	320	3·20	266	2·10	86
10.....	2·90	213	2·80	196	1·90	61	3·60	338	3·20	266	1·80	50
11.....	3·10	248	2·50	146	1·90	61	3·60	338	3·50	320	1·40	17
12.....	3·10	248	2·40	130	1·80	50	3·60	338	3·00	230	1·30	12
13.....	3·20	266	2·00	73	1·80	50	3·60	338	2·80	196	1·20	7
14.....	3·40	302	1·80	50	1·80	50	3·60	338	3·10	248	1·20	7
15.....	2·40	130	1·60	31	1·80	50	3·60	338	3·20	266	1·20	7
16.....	2·30	114	1·50	24	2·10	86	3·60	338	3·00	230	1·20	7
17.....	2·20	99	1·50	24	2·10	86	3·60	338	3·20	266	1·20	7
18.....	2·10	86	1·50	24	2·00	73	3·50	320	3·00	230	1·20	7
19.....	2·20	99	1·50	24	2·20	99	3·50	320	3·20	266	1·00	1
20.....	2·30	114	1·50	24	2·70	179	3·20	266	3·20	266	1·00	1
21.....	2·30	114	1·50	24	3·50	320	3·20	266	3·20	266	1·00	1
22.....	2·30	114	1·50	24	3·50	320	2·90	213	2·90	213	1·00	1
23.....	2·30	114	1·50	24	3·50	320	3·20	266	1·60	31	0·90	0
24.....	2·00	73	1·50	24	3·50	320	3·50	320	2·30	114	0·90	0
25.....	2·00	73	2·10	86	3·50	320	3·50	320	3·20	266	0·90	0
26.....	2·00	73	3·30	284	3·50	320	3·50	320	3·20	266	0·90	0
27.....	2·10	86	3·20	266	3·50	320	3·50	320	3·20	266	0·80	0
28.....	2·10	86	1·90	61	3·60	338	3·50	320	2·60	162	0·80	0
29.....	2·10	86	1·70	40	3·70	356	2·90	213	2·40	130	0·80	0
30.....	2·10	86	1·70	40	3·80	374	1·50	24	1·70	40	0·80	0
31.....	2·10	86	.....	.....	3·50	320	1·50	24	.....	.....	0·80	0

BOW RIVER AT BANFF, ALTA.

This station was established May 25th, 1909, by P. M. Sauder. It is located at the highway bridge in the village of Banff, about one mile from the Canadian Pacific Railway Station. It is a short distance above the mouth of Spray River and below the Vermilion Lakes.

The channel above the station is straight for about 300 feet, but turns sharply to the right at about 600 feet upstream. The current is sluggish about 300 yards above the station but is fairly swift at the station. The channel below the station is straight for about 400 feet, then curves to the right. The stream breaks into rapids a short distance below the station and reaches the Spray Falls about a quarter of a mile below.

The stream is divided into four channels by the piers supporting the bridge. Both banks are low and covered with brush, but not liable to overflow. The bed of the stream is composed of gravel and boulders. There is a deep hole at the station near the right bank, but the greater part of the cross-section is uniform.

Discharge measurements are made from the bridge. The initial point for soundings is one and one-half feet from the north end of the bridge. The distances are marked on the bottom cord of the downstream side of the bridge.

A plain staff gauge, graduated to feet and tenths, is attached vertically to the downstream side of the centre pier. It is referred to a bench mark on the top of the same pier; elevation 6.51. The gauge was read twice daily by N. B. Sanson, Meteorological Observer, at Banff.

DISCHARGE Measurements of Bow River at Banff, Alta., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
June 9	P. M. Sauder	316·5	1,228	3·05	2·69	3,737
June 23	J. C. Keith	319·5	1,513	4·09	3·55	6,184
July 8	....do	320·5	1,931	5·48	4·86	10,586
July 22	....do	312·5	1,260	3·20	2·875	4,033
August 9	....do	298·0	1,045	2·27	2·38	2,379
September 3	....do	294·0	994	2·12	2·20	2,104
September 23	....do	257·0	774	1·43	1·50	1,122

DAILY mean Gauge Height and Discharge of Bow River at Banff, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge
	Feet.	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*
1	.....	.....	2·80	4,015	3·50	6,020
2	.....	.....	3·70	6,680	3·50	6,020
3	.....	.....	4·10	8,020	3·60	6,350
4	.....	.....	3·70	6,680	3·70	6,680
5	.....	.....	3·40	5,715	3·90	7,345
6	.....	.....	3·00	4,560	4·20	8,360
7	.....	.....	2·80	4,015	5·00	11,060
8	.....	.....	2·60	3,510	5·00	11,060
9	.....	.....	2·70	3,760	4·50	9,380
10	.....	.....	3·00	4,560	4·10	8,020
11	.....	.....	3·50	6,020	4·00	7,680
12	.....	.....	3·80	7,010	3·70	6,680
13	.....	.....	4·00	7,680	3·50	6,020
14	.....	.....	4·00	7,680	3·30	5,415
15	.....	.....	4·00	7,680	3·20	5,120
16	.....	.....	4·00	7,680	3·20	5,120
17	.....	.....	4·40	9,040	3·20	5,120
18	.....	.....	4·30	8,700	3·10	4,830
19	.....	.....	4·30	8,700	2·95	4,390
20	.....	.....	4·10	8,020	2·85	4,090
21	.....	.....	4·10	8,020	2·80	3,920
22	.....	.....	3·90	7,345	2·90	4,090
23	.....	.....	3·50	6,020	3·00	4,200
24	.....	.....	3·30	5,415	3·10	4,330
25	1·60	1,400	3·10	4,840	3·00	4,100
26	1·80	1,770	3·10	4,840	3·00	4,060
27	2·00	2,170	3·10	4,840	3·10	4,190
28	2·30	2,800	3·20	5,125	3·10	4,130
29	2·60	3,510	3·10	4,840	3·00	3,920
30	2·50	3,260	3·20	5,125	3·00	3,880
31	2·50	3,260	.....	.....	3·00	3,820

DAILY mean Gauge Height and Discharge of Bow River at Banff, for 1909—*Concluded.*

Day.	August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec. ft.*
1	3·00	3,780	2·10	1,955	1·75	1,460	0·90	475
2	2·90	3,560	2·10	1,955	1·60	1,250	0·90	475
3	2·80	3,350	2·20	2,100	1·60	1,250	0·95	525
4	2·70	3,140	2·20	2,100	1·50	1,120	0·95	525
5	2·70	3,080	2·10	1,955	1·50	1,120	0·90	475
6	2·55	2,800	2·10	1,955	1·40	1,000	0·90	475
7	2·40	2,500	2·10	1,955	1·50	1,120	0·80	375
8	2·40	2,450	2·20	2,100	1·40	1,000	0·80	375
9	2·40	2,400	2·10	1,955	1·30	890	0·90	475
10	2·30	2,250	2·10	1,955	1·40	1,000	0·90	475
11	2·40	2,400	2·10	1,955	1·40	1,000	0·90	475
12	2·40	2,400	2·00	1,810	1·30	890	.....	.....
13	2·40	2,400	1·90	1,670	1·30	890	.....	.....
14	2·40	2,400	1·90	1,670	1·30	890	.....	.....
15	2·40	2,400	1·80	1,530	1·20	785	.....	.....
16	2·40	2,400	1·80	1,530	1·20	785	.....	.....
17	2·40	2,400	1·80	1,530	1·20	785	.....	.....
18	2·30	2,250	1·90	1,670	1·10	680	.....	.....
19	2·40	2,400	1·80	1,530	1·10	680	.....	.....
20	2·40	2,400	1·70	1,390	1·10	680	.....	.....
21	2·40	2,400	1·60	1,250	1·10	680	.....	.....
22	2·30	2,250	1·60	1,250	1·10	680	.....	.....
23	2·20	2,100	1·50	1,120	1·10	680	.....	.....
24	2·10	1,955	1·40	1,000	1·10	680	.....	.....
25	2·10	1,955	1·40	1,000	1·00	575	.....	.....
26	2·30	2,250	1·40	1,000	1·00	575	.....	.....
27	2·50	2,560	1·40	1,000	1·00	575	.....	.....
28	2·25	2,175	1·40	1,000	0·95	525	.....	.....
29	2·10	1,955	1·40	1,000	0·95	525	.....	.....
30	2·10	1,955	1·75	1,460	1·00	575	.....	.....
31	2·10	1,955	.....	.....	0·95	525	.....	.....

NOTE.—On September 23rd the gauge was lowered 1 foot and all previous observations were increased 1 foot to apply to the present position of the gauge.

MONTHLY Discharge of Bow River at Banff, Alta., for 1909.

[Drainage area, 876 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
May (25-31)	3,510	1,400	2,595.7	2.963	0.771	36,039
June	9,040	3,510	6,204.5	7.082	7.901	369,193
July	11,060	3,920	5,787.1	6.606	7.616	355,833
August	3,780	1,955	2,473.2	2.823	3.255	152,068
September	2,100	1,000	1,578.3	1.801	2.009	93,918
October	1,460	525	834.5	0.952	1.097	51,311
November (1-11)	525	375	465.9	0.532	0.218	10,165
The period	.....	.....	.....	.....	.....	1,068,527

Elbow River at Calgary, Alta.

This station was established May 8th, 1908, by P. M. Sauder. It is located near the old General Hospital in Calgary, in the southeast quarter of section 15, township 24, range 1 west of the 5th Meridian. There are no tributaries below this station and there is no water diverted from the river except that used by the City of Calgary, whose intake is about eleven miles upstream.

The stream is confined to one channel. The left bank is high and does not overflow. The right bank is covered with brush and may overflow at extreme flood stage of the stream. The bed of the stream is composed of boulders and gravel and is not liable to change at the station, but may do so further up the stream where there is a small ripple. The channel is straight for about 500 feet below and above the station. The current is slow in low water stages of the stream but fairly swift in the higher stages.

Discharge measurements are made by means of a cable-car, tagged wire and stay wire. The initial point for soundings is the zero of the tagged wire, at its fastening to the cable support, on the left bank.

The gauge is a plain staff gauge, graduated to feet and hundredths, attached to a twelve inch post sunk in the bed of the stream at the left bank. It is referred to a bench mark on a post on the left bank about 31 feet north of the cable; elevation 15.26, and to a bench mark on the hydrant on the corner of 13th Ave. E. and 6th St.; elevation 19.62. It was read daily during 1908 by John B. Ritchie, and by Mrs. I. S. White during 1909.

Discharge Measurements of Elbow River at Calgary, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 8	P. M. Sauder	132.5	280	0.76	1.00	212
May 15	H. R. Carscallen	137.5	369	1.49	1.655	550
June 6	P. M. Sauder	158.5	922	5.34	5.30	4925
July 21	H. R. Carscallen	139.5	370	1.43	1.67	529
July 25	....do	139.0	350	1.27	1.525	445
September 3	....do	138.0	303	0.95	1.115	287
October 7	P. M. Sauder	135.0	288	0.87	1.05	252
1909.						
May 7	H. R. Carscallen	133.0	278	0.83	0.755	230
May 18	P. M. Sauder	138.0	355	1.35	1.325	478
May 26	....do	157.0	667	3.72	3.43	2487
June 8	J. C. Keith	141.0	467	2.09	2.11	976
June 24	....do	140.0	444	1.94	1.94	860
July 2	....do	140.0	425	1.82	1.82	775
July 15	....do	139.0	415	1.80	1.76	749
August 7	....do	138.0	359	1.37	1.40	493
August 30	....do	135.0	294	0.92	0.975	270

PLATE No. 7.

Cable Car and Gauge on Elbow River at Calgary, Alta.

PLATE No. 8.

Cable and Car on Elbow River at Calgary, Alta.

DAILY Gauge Height and Discharge of Elbow River, at Calgary, Alta., for 1908.

Day.	May.		June.		July.	
	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.35	2,022	2.15	882
2	.....	.....	5.70	5,615	2.30	1,000
3	.....	.....	4.40	3,435	2.30	1,000
4	.....	.....	5.00	4,400	2.30	1,000
5	.....	.....	5.60	5,440	2.30	1,000
6	.....	.....	5.60	5,440	2.20	920
7	.....	.....	4.85	4,152	2.15	882
8	1.00	212	4.15	3,062	2.10	845
9	1.50	460	3.85	2,637	2.10	845
10	1.40	410	3.70	2,440	2.10	845
11	1.30	360	3.70	2,440	2.05	810
12	1.45	435	3.50	2,195	2.00	775
13	1.55	490	3.25	1,910	2.00	775
14	1.65	550	3.00	1,640	1.90	705
15	1.70	580	3.00	1,640	1.90	705
16	1.75	610	3.00	1,640	1.80	640
17	2.35	1,040	2.70	1,340	1.80	640
18	2.15	882	2.50	1,165	1.90	705
19	2.00	775	2.50	1,165	1.90	705
20	2.05	810	2.65	1,295	1.80	640
21	2.05	810	2.70	1,340	1.80	640
22	2.00	775	2.55	1,207	1.75	610
23	1.90	705	2.50	1,165	1.70	580
24	1.90	705	2.55	1,207	1.70	580
25	1.95	740	2.80	1,435	1.60	520
26	2.05	810	2.95	1,587	1.50	460
27	2.10	845	2.95	1,587	1.50	460
28	2.10	845	2.70	1,340	1.40	410
29	2.10	845	2.40	1,080	1.40	410
30	2.05	810	2.25	960	1.30	360
31	2.50	1,165	.....	.....	1.30	360

DAILY Gauge Height and Discharge at Elbow River, at Calgary, Alta., for 1908.—*Con.*

Day.	August.		September.		October.		November.	
	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	1.30	360	1.20	310	1.10	260	1.30	360
2	1.30	360	1.20	310	1.10	260	1.20	310
3	1.30	360	1.20	310	1.10	260	1.10	260
4	1.30	360	1.20	310	1.10	260	1.00	212
5	1.30	360	1.20	310	1.10	260	1.00	212
6	1.20	310	1.20	310	1.10	260	1.00	212
7	1.20	310	1.20	310	1.10	260	1.00	212
8	1.20	310	1.20	310	1.10	260	1.00	212
9	1.20	310	1.10	260	1.10	260	1.00	212
10	1.20	310	1.10	260	1.10	260	1.00	212
11	1.25	335	1.10	260	1.10	260	1.00	212
12	1.30	360	1.10	260	1.10	260	1.00	212
13	1.30	360	1.10	260	1.00	212	.....	.....
14	1.30	360	1.10	260	1.00	212	.....	.....
15	1.30	360	1.10	260	1.00	212	.....	.....
16	1.30	360	1.10	260	1.00	212	.....	.....
17	1.20	310	1.10	260	1.00	212	.....	.....
18	1.20	310	1.10	260	1.00	212	.....	.....
19	1.20	310	1.10	260	1.00	212	.....	.....
20	1.20	310	1.10	260	1.00	212	.....	.....
21	1.10	260	1.10	260	1.00	212	.....	.....
22	1.10	260	1.10	260	1.00	212	.....	.....
23	1.10	260	1.10	260	1.00	212	.....	.....
24	1.40	410	1.15	285	1.00	212	.....	.....
25	1.40	410	1.20	310	1.00	212	.....	.....
26	1.35	385	1.20	310	1.00	212	.....	.....
27	1.30	360	1.20	310	1.05	236	.....	.....
28	1.20	310	1.20	310	1.10	260	.....	.....
29	1.20	310	1.10	260	1.20	310	.....	.....
30	1.20	310	1.10	260	1.25	335	.....	.....
31	1.20	310	.....	.....	1.30	360	.....	.....

DAILY Gauge Height and Discharge of Elbow River, at Calgary, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec-ft.*	*Feet.*	*Sec.-ft*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*
1.....	0.60	220	3.34	2,370	1.89	823	1.72	695	0.97	271	0.84	240
2.....	0.90	250	3.32	2,345	1.82	770	1.65	645	0.95	265	0.84	240
3.....	1.23	391	4.10	3,320	1.88	815	1.64	638	0.96	268	0.83	238
4.....	1.42	502	2.85	1,765	2.02	927	1.57	592	0.95	265	0.82	236
5.....	1.03	293	2.87	1,789	2.19	1,076	1.62	624	0.95	265	0.82	236
6.....	0.82	236	2.71	1,601	2.30	1,180	1.59	604	0.94	262	0.82	236
7.....	0.86	243	2.45	1,325	3.27	2,282	1.40	490	0.94	262	0.81	235
8.....	0.85	241	2.10	1,095	2.77	1,670	1.43	508	0.93	259	0.80	233
9.....	0.91	253	2.06	961	2.40	1,275	1.42	502	0.93	259	0.79	232
10.....	1.06	307	2.07	969	2.35	1,227	1.35	460	0.92	256	0.79	232
11.....	1.29	425	2.37	1,246	2.25	1,132	1.33	448	0.94	262	0.79	232
12.....	1.50	550	2.66	1,546	2.06	961	1.32	442	0.93	259	0.78	231
13.....	1.66	652	2.61	1,491	2.15	1,040	1.31	436	0.92	256	0.78	231
14.....	1.49	544	2.65	1,535	2.01	918	1.29	425	0.91	253	0.77	230
15.....	1.70	680	2.59	1,470	1.95	870	1.28	419	0.92	256	0.76	230
16.....	1.56	586	2.69	1,579	1.76	725	1.25	402	0.91	253	0.79	232
17.....	1.43	508	2.75	1,647	1.69	673	1.24	397	0.90	250	0.78	231
18.....	1.32	442	2.68	1,568	1.66	652	1.23	391	0.92	256	0.78	231
19.....	1.79	748	2.51	1,385	1.65	645	1.20	375	0.92	256	0.77	230
20.....	2.04	944	2.40	1,275	1.65	645	1.19	370	0.91	253	0.77	230
21.....	2.03	935	2.29	1,171	1.58	598	1.19	370	0.91	253	0.77	230
22.....	2.06	961	2.26	1,142	1.55	580	1.17	360	0.91	253	0.76	230
23.....	2.34	1,218	2.15	1,040	1.45	520	1.16	355	0.91	253	0.76	230
24.....	2.81	1,717	1.94	862	1.43	508	1.12	335	0.90	250	0.75	229
25.....	3.06	2,020	1.91	838	1.42	502	1.09	320	0.90	250	0.75	229
26.....	3.65	2,757	2.00	910	1.44	514	1.07	311	0.91	253	0.74	228
27.....	3.28	2,295	1.87	807	1.65	645	1.04	298	0.89	248	0.73	227
28.....	3.40	2,445	1.86	800	2.66	1,546	1.05	302	0.85	241	0.73	227
29.....	3.39	2,433	1.79	748	2.42	1,295	1.02	289	0.83	238	0.73	227
30.....	3.25	2,257	1.75	717	2.01	918	0.98	274	0.85	241	0.72	226
31.....	3.01	1,957	.....	.....	1.98	894	0.97	271	.....	.....	0.72	226

MONTHLY Discharge of Elbow River at Calgary, Alta., for 1908–9.

[Drainage area, 466 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
May (8–31)	1,165	212	694.5	1.49	1.330	33,060
June	5,615	960	2,266.0	4.86	5.422	134,834
July	1,000	360	700.3	1.50	1.729	43,060
August	410	260	332.6	0.71	0.819	20,450
September	310	260	280.8	0.60	0.669	16,709
October	360	212	244.8	0.52	0.600	15,052
November (1–12)	360	212	236.5	0.50	0.223	5,629
The period	.....	.....	.....	.....	.....	268,794
1909.						
May	2,757	220	968.0	2.070	2.386	59.520
June	3,320	717	1,377.2	2.950	3.291	81.952
July	2,282	502	929.9	1.995	2.300	57,177
August	695	271	430.6	0.920	1.061	26.476
September	271	238	255.5	0.548	0.612	15,203
October	240	226	231.4	0.490	0.565	14,228
The period	.....	.....	.....	.....	.....	254,556

JUMPINGPOUND CREEK, NEAR JUMPING POUND P.O., ALTA.

This station was established in 1906, by J. F. Hamilton. It is located at a traffic bridge on a road diversion on section 30, township 24, range 4 west of the 5th Meridian. Mr. John Bateman, the postmaster at Jumping Pound, lives about 300 yards west of the bridge.

The channel is straight for about 600 feet above and 500 feet below the station. The current is sluggish at, and above the station, but breaks into rapids about 150 feet below the station. The right bank is composed of gravel and boulders, covered with clay, and not liable to overflow. The left bank is similar, but not so high, and liable to overflow in excessive floods. The bed of the stream is composed of course gravel and boulders. It is rough and may shift in flood stages. The stream is divided into several channels during its higher stages by a pier and pile bents supporting the bridge.

During higher stages of the stream, discharge measurements are made from the down stream side of the bridge. The initial point for soundings is the west side of the right abutment. Distances are marked on the railing of the bridge, at every five feet from the initial point. At low water stage of the stream discharge measurements are made at wading sections, either above or below the bridge.

The gauge, which is a plain staff, graduated to feet and hundredths is attached vertically to the downstream face of the first pile bent west of the main truss of the bridge. The gauge is referred to a bench mark on the north end of the cap of the right pile bent; elevation 10.90 above the zero of the gauge.

The gauge was read once each day by John Bateman.

Discharge Measurements of Jumpingpound Creek near Jumping Pound, P.O., Alta., in 1906–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1906.						
June 15	J. F. Hamilton	103	289	0.60	2.70	162
June 16*	....do	.....	.....	.....	2.75	189
1908.						
May 6	P. M. Sauder	99.3	250	0.22	2.30	55
May 6*	....do	49.4	65	0.88	2.30	57
July 23*	H. R. Carscallen	57.0	74	0.96	2.36	71
September 4	....do	89.0	187	0.17	2.05	32
1909.						
June 28	J. C. Keith	95.0	212	0.53	2.48	113
July 20	....do	87.0	195	0.33	2.24	64
September 7*	....do	28.5	34	0.70	1.96	24

* Measurements taken at wading sections.

Daily Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, P.O., Alta., for 1908.

Day.	April.		May.		June	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.40	.....	5.00	751
2	.....	.....	2.30	.....	5.30	829
3	.....	.....	2.30	.....	4.70	673
4	.....	.....	2.30	.....	5.00	751
5	.....	.....	2.30	.....	5.30	829
6	.....	.....	2.30	.....	5.00	751
7	.....	.....	2.30	.....	4.70	673
8	.....	.....	2.50	.....	4.00	491
9	.....	.....	2.80	.....	3.90	465
10	.....	.....	2.70	.....	3.60	387
11	.....	.....	2.60	.....	3.50	361
12	.....	.....	2.50	.....	3.50	361
13	.....	.....	2.70	.....	3.40	336
14	.....	.....	2.80	.....	3.40	336
15	.....	.....	3.00	.....	3.30	311
16	.....	.....	3.30	.....	3.30	311
17	.....	.....	3.30	.....	3.20	286
18	.....	.....	3.10	.....	3.20	286
19	2.50	.....	3.20	.....	3.10	261
20	2.45	.....	3.30	.....	3.30	311
21	2.40	.....	3.30	.....	3.30	311
22	2.40	.....	3.20	.....	3.20	286
23	2.35	.....	3.20	.....	3.20	286
24	2.30	.....	3.10	.....	3.10	261
25	2.30	.....	3.10	.....	3.00	236
26	2.30	.....	3.20	.....	3.00	236
27	2.30	.....	3.30	.....	3.30	311
28	2.40	.....	3.20	.....	3.20	286
29	2.40	.....	3.20	.....	3.00	236
30	2.40	.....	3.50	.....	3.00	236
31	.....	.....	3.70	.....	.....	.....

DAILY Gauge Height and Discharge of Jumpingpound Creek, near Jumping Pound, P.O., Alta., for 1908.—*Con.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.80	186	2.20	57	2.20	57	2.00	27
2	2.70	162	2.20	57	2.10	40	2.10	40
3	2.60	139	2.20	57	2.10	40	2.10	40
4	2.60	139	2.20	57	2.10	40	2.10	40
5	2.60	139	2.10	40	2.00	27	2.10	40
6	2.60	139	2.10	40	2.00	27	2.10	40
7	2.60	139	2.10	40	2.00	27	2.10	40
8	2.50	117	2.10	40	2.00	27	2.10	40
9	2.50	117	2.10	40	2.00	27	2.10	40
10	2.50	117	2.10	40	2.00	27	2.10	40
11	2.40	96	2.20	57	2.00	27	2.10	40
12	2.40	96	2.30	76	2.00	27	2.10	40
13	2.40	96	2.30	76	2.00	27	2.10	40
14	2.40	96	2.20	57	2.00	27	2.10	40
15	2.40	96	2.20	57	2.00	27	2.10	40
16	2.50	117	2.20	57	2.00	27	2.10	40
17	2.50	117	2.20	57	1.90	20	2.10	40
18	2.40	96	2.10	40	1.90	20	2.10	40
19	2.40	96	2.10	40	1.90	20	2.10	40
20	2.40	96	2.10	40	1.90	20	2.10	40
21	2.40	96	2.10	40	1.90	20	2.10	40
22	2.40	96	2.00	27	1.90	20	2.10	40
23	2.30	76	2.00	27	1.90	20	2.10	40
24	2.30	76	2.10	40	1.90	20	2.10	40
25	2.30	76	2.20	57	2.00	27	2.10	40
26	2.20	57	2.20	57	2.10	40	2.10	40
27	2.20	57	2.20	57	2.10	40	.....	.....
28	2.20	57	2.20	57	2.10	40	.....	.....
29	2.20	57	2.10	40	2.00	27	.....	.....
30	2.20	57	2.20	57	2.00	27	.....	.....
31	2.20	57	2.20	57	.....	.....	.....	.....

NOTE.—Rating table does not apply to gauge heights previous to June 1st.

DAILY Gauge Height and Discharge of Jumpingpound Creek near Jumping Pound, P.O., Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec-ft.*	*Feet.*	*Sec.-ft*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*	*Feet.*	*Sec-ft.*
1.....	2.60	139	3.30	311	2.30	76	2.50	117	2.00	27	1.90	20
2.....	2.60	139	3.20	286	2.30	76	2.40	96	2.00	27	1.90	20
3.....	2.70	162	3.10	261	2.30	76	2.40	96	2.00	27	1.90	20
4.....	2.70	162	3.10	261	2.30	76	2.40	96	2.00	27	1.90	20
5.....	2.60	139	3.20	286	2.30	76	2.40	96	2.00	27	1.90	20
6.....	2.50	117	3.20	286	2.40	96	2.40	96	2.00	27	1.90	20
7.....	2.50	117	3.20	286	3.00	236	2.30	76	2.00	27	1.90	20
8.....	2.40	96	3.10	261	2.80	186	2.30	76	2.00	27	1.90	20
9.....	2.40	96	3.10	261	2.70	162	2.30	76	2.00	27	1.90	20
10.....	2.30	76	3.00	236	2.70	162	2.30	76	2.00	27	1.90	20
11.....	2.40	96	3.00	236	2.60	139	2.40	96	2.00	27	1.90	20
12.....	2.60	139	2.90	211	2.60	139	2.30	76	2.00	27	1.90	20
13.....	2.80	186	2.90	211	2.70	162	2.30	76	2.00	27	1.90	20
14.....	2.80	186	2.80	186	2.70	162	2.20	57	2.00	27	1.90	20
15.....	2.70	162	2.80	186	2.60	139	2.20	57	2.00	27	1.90	20
16.....	2.70	162	2.70	162	2.50	117	2 20	57	2.00	27	1.90	20
17.....	2.80	186	2.70	162	2.50	117	2.20	57	2.00	27	1.90	20
18.....	2.80	186	2.60	139	2.40	96	2.20	57	2.00	27	1.90	20
19.....	2.60	139	2.60	139	2.40	96	2.20	57	2.00	27	1.90	20
20.....	2.90	211	2.50	117	2.30	76	2.10	40	2.00	27	1.90	20
21.....	3.10	261	2.50	117	2.30	76	2.10	40	1.90	20	1.90	20
22.....	3.30	311	2.50	117	2.30	76	2.10	40	1.90	20	1.90	20
23.....	3.30	311	2.50	117	2.30	76	2.10	40	1.90	20	1.90	20
24.....	4.00	491	2.60	139	2.20	57	2.10	40	1.90	20	1.90	20
25.....	4.00	491	2.60	139	2.20	57	2.10	40	1.90	20	1.90	20
26.....	3.80	439	2.60	139	2.60	139	2.10	40	1.90	20	1.90	20
27.....	3.60	387	2.50	117	2.60	139	2.10	40	1.90	20	1.90	20
28.....	3.50	361	2.40	96	2.90	211	2.00	27	1.90	20	1.90	20
29.....	3.40	336	2.40	96	2.80	186	2.00	27	1.90	20	1.90	20
30.....	3.30	311	2.40	96	2.70	162	2.00	27	1.90	20	1.90	20
31.....	3.30	311	.....	.....	2.50	117	2.00	27	.....	.....	1.90	20

Monthly Discharge of Jumpingpound Creek near Jumping Pound, P.O., Alta., for 1908–9.

[Drainage area, 178 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
June	829	236	414.8	2.330	2.600	24,684
July	186	57	101.9	0.572	0.659	6,264
August	57	27	49.7	0.279	0.322	3,056
September	57	20	28.7	0.161	0.180	1,710
October (1-26)	40	27	39.5	0.222	0.215	2,037
The period	.....	.....	.....	.....	.....	37,751
1909.						
May	491	76	222.8	1.251	1.442	13,698
June	311	96	188.6	1.059	1.182	11,221
July	236	57	121.3	0.681	0.785	7,459
August	117	27	61.9	0.347	0.400	3,806
September	27	20	24.7	0.138	0.154	1,468
October	20	20	20.0	0.112	0.129	1,230
The period	.....	.....	.....	.....	.....	38,882

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Nose Creek, near Calgary, Alta., in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
July 19	J. C. Keith	N. W. 13-24-1-5	19	15.8	23.4
September 2	do	do	9	4.0	5.8
September 18	do	do	9.3	4.2	5.7

Miscellaneous Discharge Measurements of Bow River, in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
September 8	J. C. Keith	Road allowance E. of sec. 34-25-4-5	305	813	4,017
September 10	do	Morley bridge on Stony Indian Reserve	178.5	966	3,390
October 20	P. M. Sauder	Intake S.A.L.Co., S.E. 31-21-25-4	336	887	2,874

MISCELLANEOUS Discharge Measurements of tributaries of Bow River, by J. C. Keith, in 1909.

Date.	Stream.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq.-ft.*	*Sec.-ft.*
September 9	Bighill Creek	Sec. 10-26-4-5	10	5.75	6.4
September 9	Horse Creek	Sec. 8-26-4-5	.....	.....	Dry.
September 9	Grand Valley Creek	Sec. 24-26-5-5	7.8	3.04	0.80
September 9	Beaupre Creek	Sec. 15-26-5-5	.....	.....	Dry.
September 9	Spencer Creek	Sec. 17-26-5-5	8.	2.17	1.88
September 9	Ghost River	Sec. 24-26-6-5	70.	153.	303.
September 9	Jacob Creek	On Stony Indian Reserve, near mouth	.....	.....	Dry.
September 10	Cripple Creek	On Stony Indian Reserve, near mouth	4	1.29	0.73
September 10	Oldfort Creek	On Stony Indian Reserve, near mouth	11.6	6.06	10.57

FISH CREEK NEAR PRIDDIS, ALTA.

This station was established May 13th, 1907, by P. M. Sauder. It is on the south-west quarter of section 26, township 22, range 3 west of the 5th meridian, near John L. Bremner's buildings, and about one mile from Priddis.

A plain staff gauge, graduated to feet and hundredths, is placed vertically at the left bank, about 200 yards north of Mr. Bremner's house. It is read once each day by Mr. Bremner. Bench mark No. 1 is a block of wood fastened on the north east corner of a frame stable near the road; elevation 9.26. Bench mark No. 2 is two spikes driven about two feet from the ground, in a telephone post 259 feet west of the gauge; elevation 8.65 above the zero of the gauge.

The channel is straight for 100 feet above the station and for 200 feet below the station. The left bank is high, and will not overflow. The right bank is low, covered with brush and timber, and is liable to overflow in extreme high water. The bed is composed of gravel, but not liable to shift. The current is slugglsh in extreme low water stage of the stream.

Measurements are made by wading at or near the gauge, during low water stages of the stream, and high water stages are computed from slope measurements by the use of Kutter's formula. It is proposed to establish a cable station at this point for high water measurements.

Discharge Measurements of Fish Creek near Priddis, Alta., in 1907-8-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 13	P. M. Sauder	38.0	46	0.87	1.00	40.3
October 18	I. J. Walmsley	35.0	23	1.06	0.85	24.4
1908.						
May 20	P. M. Sauder	53.0	112	2.54	2.395	285
July 17	H. R. Carscallen	47.5	81	1.74	1.85	140
July 27	do	37.0	34	0.59	0.76	20.2
August 31	do	36.0	37	0.63	0.785	23.2
September 30	do	38.0	41	0.70	0.88	29.1
November 6	P. M. Sauder	35.5	31	0.36	0.575	11.12
1909.						
June 21	J. C. Keith	39.5	50	0.97	1.10	48.7
July 31	do	38.0	47	1.00	1.05	46.6
August 24	do	31.5	27	0.29	0.42	7.74
September 20	do	15.0	8	0.97	0.43	7.79
October 24	P. M. Sauder	30.0	23	0.33	0.44	7.72

Daily Gauge Height and Discharge of Fish Creek, near Priddis, Alta., for 1908.

Day.	June.		July.		August.		September.		October.	
	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.	Gauge. height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.60	104	0.70	17	0.70	17	0.90	31
2	.....	.....	1.50	91	0.80	23	0.60	12	1.00	40
3	.....	.....	1.50	91	0.80	23	0.60	12	1.10	49
4	.....	.....	1.40	79	0.70	17	0.50	9	0.90	31
5	.....	.....	1.40	79	0.60	12	0.50	9	0.90	31
6	.....	.....	1.30	68	0.60	12	0.40	6	0.90	31
7	.....	.....	1.30	68	0.60	12	0.40	6	0.80	23
8	.....	.....	1.20	58	0.60	12	0.40	6	0.80	23
9	.....	.....	1.10	49	0.60	12	0.40	6	0.70	17
10	.....	.....	1.10	49	0.60	12	0.50	9	0.70	17
11	3.40	496	1.10	49	0.70	17	0.40	6	0.70	17
12	3.00	382	1.00	40	1.00	40	0.40	6	0.70	17
13	2.60	284	1.00	40	1.00	40	0.40	6	0.70	17
14	2.50	262	1.00	40	0.90	31	0.40	6	0.60	12
15	2.40	240	1.10	49	0.80	23	0.40	6	0.70	17
16	2.30	220	1.30	68	0.70	17	0.40	6	0.70	17
17	2.20	200	1.50	91	0.70	17	0.40	6	0.70	17
18	2.00	165	1.60	104	0.70	17	0.40	6	0.70	17
19	2.00	165	1.40	79	0.60	12	0.50	9	0.60	12
20	2.20	200	1.30	68	0.50	9	0.50	9	0.70	17
21	3.00	382	1.10	49	0.50	9	0.40	6	0.90	31
22	2.70	307	1.10	49	0.50	9	0.40	6	0.90	31
23	2.30	220	0.90	31	0.50	9	0.40	6	0.70	17
24	2.30	220	0.90	31	0.60	12	0.50	9	0.70	17
25	1.90	148	0.80	23	0.70	17	0.60	12	0.80	23
26	1.70	118	0.80	23	0.70	17	0.60	12	0.80	23
27	2.00	165	0.80	23	0.70	17	0.60	12	0.70	17
28	1.90	148	0.70	17	0.50	9	0.70	17	0.70	17
29	1.80	132	0.80	23	0.50	9	0.80	23	0.70	17
30	1.70	118	0.70	17	0.60	12	0.80	23	0.80	23
31	.....	.....	0.60	12	0.80	23	.....	.....	0.80	23

Measurement by wading, Fish Creek, near Priddis, Alta.

Daily Gauge Height and Discharge of Fish Creek, near Priddis, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.50	91	0.90	31	1.05	44.5	0.45	7.5	0.40	6.0
2	.....	.....	1.50	91	0.80	23	1.00	40	0.45	7.5	0.40	6.0
3	3.40	496	1.40	79	0.80	23	0.90	31	0.45	7.5	0.40	6.0
4	2.40	240	1.30	68	0.80	23	0.90	31	0.50	9.0	0.40	6.0
5	1.60	104	1.40	79	1.20	58	0.80	23	0.50	9.0	0.40	6.0
6	1.40	79	1.60	104	1.50	91	0.90	31	0.50	9.0	0.40	6.0
7	1.30	68	1.50	91	2.10	182	0.90	31	0.45	7.5	0.40	6.0
8	1.20	58	1.40	79	2.00	165	0.80	23	0.45	7.5	0.40	6.0
9	1.30	68	1.30	68	1.70	118	0.70	17	0.40	6.0	0.40	6.0
10	1.30	68	1.20	58	1.50	91	0.70	17	0.40	6.0	0.40	6.0
11	1.50	91	1.20	58	1.40	79	0.70	17	0.35	5.0	0.40	6.0
12	1.60	104	1.10	49	1.60	104	0.70	17	0.35	5.0	0.40	6.0
13	3.00	382	1.10	49	1.40	79	0.60	12	0.35	5.0	0.40	6.0
14	2.80	331	1.10	49	2.00	165	0.60	12	0.35	5.0	0.40	6.0
15	3.00	382	1.10	49	1.60	104	0.60	12	0.35	5.0	0.40	6.0
16	2.40	240	1.10	49	1.40	79	0.50	9	0.35	5.0	0.40	6.0
17	2.20	200	1.10	49	1.40	79	0.50	9	0.35	5.0	0.40	6.0
18	2.00	165	1.00	40	1.20	58	0.50	9	0.40	6.0	0.40	6.0
19	2.30	220	1.00	40	1.10	49	0.50	9	0.40	6.0	0.40	6.0
20	2.80	331	1.00	40	1.00	40	0.50	9	0.45	7.5	0.40	6.0
21	3.00	382	1.10	49	1.00	40	0.50	9	0.45	7.5	0.40	6.0
22	3.60	556	1.10	49	1.00	40	0.45	7.5	0.45	7.5	0.40	6.0
23	3.30	466	1.00	40	0.90	31	0.45	7.5	0.50	9.0	0.45	7.5
24	3.30	466	1.00	40	0.90	31	0.45	7.5	0.45	7.5	0.45	7.5
25	3.20	437	1.30	68	0.90	31	0.45	7.5	0.45	7.5	0.45	7.5
26	2.60	284	1.30	68	0.80	23	0.45	7.5	0.40	6.0	0.50	9.0
27	2.20	200	1.10	49	1.00	40	0.45	7.5	0.40	6.0	0.66	15.0
28	2.20	200	1.10	49	1.50	91	0.50	9	0.40	6.0	0.60	12.0
29	1.90	148	1.00	40	1.50	91	0.45	7.5	0.40	6.0	0.50	9.0
30	1.70	118	0.90	31	1.30	68	0.45	7.5	0.40	6.0	0.40	6.0
31	1.60	104	.....	.....	1.10	49	0.45	7.5	.....	.....	0.40	6.0

Monthly Discharge of Fish Creek, near Priddis, Alta., for 1908-9.

(Drainage area, 105 square miles)

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
June (11–30)	496	118	228.6	2.177	1.619	9,068
July	104	12	53.6	0.511	0.589	3,296
August	40	9	16.7	0.159	0.183	1,027
September	23	6	9.5	0.090	0.100	563
October	49	12	22.3	0.212	0.244	1,372
The period	.....	.....	.....	.....	.....	15,326
1909.						
May (3–31)	556	58	241.0	2.295	2.475	13,860
June	104	31	58.8	0.559	0.624	3,497
July	182	23	70.2	0.668	0.770	4,316
August	44.5	7.5	15.8	0.150	0.173	970
September	9.0	5.0	6.7	0.063	0.070	397
October	15.0	6.0	6.8	0.065	0.075	419
The period	.....	.....	.....	.....	.....	23,459

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of North Branch of Fish Creek, near Priddis, Alta., in 1908.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
July 17	H. R. Carscallen	1,000 ft. from mouth	32.0	79.5	73.3
July 27	do	do	25.5	54.5	9.1
August 31	do	do	25.5	58.0	14.5
September 30	do	do	19.7	16.8	18.4

Miscellaneous Discharge Measurement of Pine Creek in section 11, tp. 22, rge. 1 west of the 5th mer., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
		Feet.	*Sq. ft.*	*Sec.-ft.*
June 14	J. C. Keith	10.5	3.2	4.0

North Branch of Sheep River at Millarville,. Alta

This station was established May 22, 1908, by P. M. Sauder. The gauge which is a plain staff, graduated to feet and hundredths, is fastened to the east end of a crib work about 100 yards from Malcolm T. Millar's house on the southwest quarter of section 12, Township 21, Range 3 west of the 5th Meridian. It is referred to a bench mark on the southwest corner of Mr. Millar's house elevation 13.89 above the zero of the gauge. Discharge measurements are made at a wading section 50 yards downstream from the gauge at low water. During high water and flood stages of the stream, discharge measurements are made from a steel highway bridge about one mile below the gauge, on the road allowance east of section 12. The initial point for soundings is the outer edge of the bed plate on the downstream side of the north end of the bridge. Distances from the initial point are marked at every five feet, on the bottom cord.

The stream is subject to sudden rises and at high stages the current is swift. During these periods the channel which is composed of gravel is liable to shift.

The gauge was read once each day by Malcolm T. Millar.

Bridge Station on North Fork of Sheep River, near Millarville, Alta.

DISCHARGE Measurements of North Branch of Sheep River, at Millarville, Alta., 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
1908.						
May 22	H. R. Carscallen	99.5	260	1.62	3.90	420
July 17	....do	66.5	212	0.67	2.68	141
August 29*	....do	38.5	20.0	0.68	2.03	13.6
September 30*	....do	32.0	22.7	1.11	2.18	25.1
November 7*	P. M. Sauder	26.2	22.7	1.03	2.16	23.3
1909.						
May 14	P. M. Sauder	97.0	280	1.32	3.06	371
June 19	J. C. Keith	62.0	205	0.71	2.40	146
July 14	....do	67.0	234	1.26	2.94	295
July 31	....do	61.0	205	0.68	2.37	139.5
August 24*	....do	22.0	16.7	1.12	1.80	18.8
September 21*	....do	21.0	12.9	0.83	1.73	10.7
October 23*	P. M. Sauder	19.0	10.7	0.63	1.67	6.8

*Measurements taken at wading sections.

DAILY Gauge Height and Discharge of North Branch of Sheep River, at Millarville, Alta., for 1909.

Day.	April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge heighht.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.50	206	2.40	180	3.30	438
2	2.50	206	2.80	290	3.60	543
3	2.50	206	3.00	351	3.20	402
4	2.60	233	3.10	384	3.10	369
5	2.60	233	3.10	384	3.10	367
6	2.60	233	2.60	233	3.00	334
7	2.60	233	2.50	206	2.90	300
8	2.70	261	2.30	154	2.70	243
9	2.70	261	2.40	180	2.70	241
10	2.70	261	2.60	233	2.70	239
11	2.70	261	2.70	261	2.70	238
12	2.70	261	2.60	233	2.70	237
13	2.70	261	2.50	206	2.70	235
14	2.50	206	3.20	418	2.60	206
15	2.50	206	3.40	485	2.50	179
16	2.30	154	3.10	383	2.50	177
17	2.50	206	3.00	351	2.50	176
18	2.50	206	3.00	350	2.50	174
19	2.50	206	3.30	448	2.50	173
20	2.50	206	3.50	518	2.50	173
21	2.50	206	3.50	517	2.50	173
22	2.50	206	4.00	704	2.50	173
23	2.60	233	3.70	591	2.50	173
24	2.70	261	4.30	815	2.40	146
25	2.70	261	4.10	739	2.50	173
26	2.60	233	3.90	663	2.50	173
27	2.70	261	3.60	551	2.50	173
28	2.60	233	3.60	550	2.30	122
29	2.60	233	3.60	549	2.30	122
30	2.40	180	3.50	510	2.30	122
31	.....	.....	3.50	508	.....	.....

DAILY Gauge Height and Discharge of North Branch of Sheep River, at Millarville, Alta., for 1909—*Con.*

Day.	July.		August.		September.		October.	
	Gauge. Height.	Discharge.	Gauge. Height.	Discharge.	Gauge. Height.	Discharge.	Gauge. Height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.30	122	2.30	122	1.80	19	1.70	9
2	2.30	122	2.30	122	1.80	19	1.70	9
3	2.30	122	2.30	122	1.80	19	1.70	9
4	2.30	122	2.30	122	1.80	19	1.70	9
5	2.90	282	2.30	122	1.80	19	1.70	9
6	3.50	478	2.30	122	1.80	19	1.70	9
7	3.10	344	2.30	122	1.70	9	1.70	9
8	3.10	344	2.20	99	1.70	9	1.70	9
9	3.10	344	2.20	99	1.70	9	1.70	9
10	2.90	282	2.20	99	1.70	9	1.70	9
11	2.70	227	2.20	99	1.70	9	1.70	9
12	2.70	227	2.10	77	1.70	9	1.70	9
13	3.00	312	2.10	77	1.70	9	1.70	9
14	2.90	282	2.10	77	1.70	9	1.70	9
15	2.80	254	2.10	77	1.70	9	1.70	9
16	2.70	227	2.10	77	1.70	9	1.70	9
17	2.60	200	2.10	77	1.70	9	1.70	9
18	2.60	200	2.10	77	1.70	9	1.70	9
19	2.60	200	2.10	77	1.70	9	1.70	9
20	2.50	173	2.00	56	1.70	9	1.70	9
21	2.50	173	2.00	56	1.70	9	1.70	9
22	2.50	173	1.90	36	1.70	9	1.70	9
23	2.50	173	1.90	36	1.70	9	1.70	9
24	2.40	146	1.80	19	1.70	9	1.70	9
25	2.30	122	1.80	19	1.70	9	1.70	9
26	2.40	146	1.80	19	1.70	9	1.70	9
27	2.40	146	1.80	19	1.70	9	1.70	9
28	3.00	312	1.80	19	1.70	9	1.70	9
29	2.60	200	1.80	19	1.70	9	1.70	9
30	2.60	200	1.80	19	1.70	9	1.70	9
31	2.40	146	1.80	19	.....	.....	1.70	9

MONTHLY Discharge of North Branch of Sheep River, at Millarville, Alta., for 1909.

[Drainage area, 192 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
April	261	154	227.1	1.182	1.319	13,513
May	815	154	417.6	2.175	2.507	25,677
June	543	122	233.1	1.214	1.354	13,870
July	478	122	219.4	1.143	1.318	13,490
August	122	19	71.0	0.370	0.427	4,366
September	19	9	11.0	0.057	0.064	654
October	9	9	9.0	0.046	.053	553
The period	.....	.....	.....	.....	.....	72,123

South Branch of Sheep River, near Black Diamond, Alta.

This station was established May 23, 1908, by P. M. Sauder. It is located at the steel highway bridge on the road allowance between sections 8 and 17, Township 20, Range 2 west of the 5th Meridian. It is one-half mile from Black Diamond P.O.

The gauge which is of the standard chain type, is fastened to the floor of the bridge on the downstream side, about midway between the west abutment and the centre pier. Bench mark, No. 1, is two nail heads on the north face of the west abutment; elevation 9.37 above the zero of the gauge. Bench mark, No. 2, is a block of wood nailed to the north face of the centre pier; elevation 7.67. The chain used at first, was not satisfactory and was replaced by a chain of better quality on July 13, 1909. Since then the results have been more satisfactory.

The channel is straight for about 300 feet above the station, then swings sharply to the left. It is straight for about 200 feet below the station, then turns gradually to the right. Both banks are composed of gravel. The right bank is low, partly covered with brush, and overflows in higher stages of the stream. The left bank is high and can not overflow. The bed is composed of coarse gravel. It is permanent in low water stage of the stream, but a gravel bar at the right bank, which is covered during high water stages is liable to shift. The river has considerable fall and the current is swift.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the outer edge of the bed plate on the west end of the bridge. Distances from the initial point are marked every five feet, on the bottom cord of the bridge.

The gauge was read once each day by Herbert Arnold, merchant at Black Diamond.

Discharge Measurements of South Branch of Sheep River, near Black Diamond, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet*	*Sec.-ft.*
May 23	H. R. Carscallen	79.5	137	3.71	.....	509
July 16	....do	94.0	138	2.56	.....	352
July 28	....do	76.0	97	1.84	.....	179
August 29	....do	74.5	80	1.47	.....	118
September 29	....do	75.0	80	1.45	.....	117
1909.						
May 15	P. M. Sauder	82.5	131	2.52	.....	329
June 19	J. C. Keith	95.5	198	4.58	.....	905
July 13	....do	93.5	175	3.06	1.62	538
July 30	....do	95.0	180	3.79	1.81	682
August 23*	....do	72.5	86	1.72	0.71	148
September 21*	....do	67.5	75	1.47	0.60	111
October 23*	P. M. Sauder	65.0	53	1.26	0.47	67

*Measurements taken at wading sections.

DAILY Gauge Height and Discharge of South Branch of Sheep River, near Black Diamond Alta., for 1909.

Day.	July.		August.		September.		October.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge heighht.	Dis-charge.	Gauge. Height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.50	465	0.60	111	0.50	78
2	.....	.....	1.40	413	0.60	111	0.50	78
3	.....	.....	1.40	413	0.65	127	0.60	111
4	.....	.....	1.30	367	0.65	127	0.50	78
5	.....	.....	1.30	367	0.65	127	0.50	78
6	.....	.....	1.20	325	0.65	127	0.50	78
7	.....	.....	1.10	287	0.60	111	0.50	78
8	.....	.....	1.00	249	0.60	111	0.50	78
9	.....	.....	1.00	249	0.60	111	0.50	78
10	.....	.....	1.00	249	0.60	111	0.60	111
11	.....	.....	1.00	249	0.60	111	0.50	78
12	.....	.....	1.00	249	0.65	127	0.50	78
13	1.60	523	1.00	249	0.60	111	0.50	78
14	1.60	523	0.90	213	0.60	111	0.50	78
15	1.40	413	0.90	213	0.65	127	0.50	78
16	1.50	465	0.90	213	0.65	127	0.50	78
17	1.50	465	0.80	178	0.60	111	0.50	78
18	1.40	413	0.80	178	0.65	127	0.50	78
19	1.30	367	0.80	178	0.65	127	0.50	78
20	1.50	465	0.80	178	0.60	111	0.50	78
21	1.40	413	0.80	178	0.60	111	0.45	63
22	1.30	367	0.70	144	0.65	127	0.45	63
23	1.20	325	0.70	144	0.65	127	0.45	63
24	1.30	367	0.70	144	0.65	127	0.45	63
25	1.30	367	0.70	144	0.60	111	0.50	78
26	1.40	413	0.70	144	0.60	111	0.50	78
27	2.50	1,260	0.70	144	0.60	111	0.50	78
28	2.70	1,428	0.70	144	0.55	94	0.50	78
29	2.00	840	0.70	144	0.55	94	0.50	78
30	2.00	840	0.70	144	0.55	94	0.50	78
31	1.60	523	0.60	111	.....	.....	0.50	78

MONTHLY Discharge of South Branch of Sheep River, near Black Diamond, Alta., for 1909.

[Drainage area, 232 square miles.]

	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet
July (13-31)	1,428	325	567.2	2.445	1.728	21,376
August	465	111	228.0	0.982	1.132	14,017
September	127	94	115.7	0.498	0.556	6,884
October	111	63	78.2	0.337	0.388	4,808
The period	.....	.....	.....	.....	.....	47,085

SHEEP RIVER NEAR OKOTOKS, ALTA.

This station was established in 1906, by J. F. Hamilton. It is located at the Canadian Pacific Railway Bridge, about one mile from Okotoks, on the west boundary of Section 22, Township 20, Range 29 west of the 4th Meridian.

A plain staff gauge, graduated to feet and tenths, was at first attached to the north face of the north pier. Later, owing to the shifting of the main channel of the stream to the right, another gauge, graduated to feet and hundredths, was attached to the north face of the south pier. Both gauges are referred to a bench mark on the top of the downstream end of the north pier; elevation 11.48. The railway company are rebuilding this bridge and arrangements are being made to have a gauge attached to the centre pier of the new bridge.

The channel is straight for about 700 feet above and 300 feet below the station. The current is swift and the channel which is composed of coarse gravel, shifts considerably. Short piles, the remains of an old pier, a few feet upstream from the station, affect the accuracy of discharge measurements. The right bank is low and composed of gravel. It overflows at high stages and shifts. The left bank is low and composed of gravel and sand. It also overflows at high water and shifts.

Discharge measurements were made from the downstream side of the bridge. The initial point for soundings is 155 feet from the north end of the trestle approach to the bridge. Distances from the initial point are marked at intervals of five feet along the downstream side of the bridge.

Sheep River falls rapidly. The banks and bed of the stream are composed of gravel and clay. The current is swift and during high water the channel shifts almost continuously. It is impossible to locate a suitable gauging station for high water stages and the daily discharges at those stages, are approximate. During low water stage the channel seldom shifts and the results are fairly good. During the latter period, discharge measurements are made at a wading section about 200 yards downstream from the bridge.

The gauge was read once each day by Wm. P. Henderson, who lives about quarter of a mile from the bridge.

Discharge Measurements of Sheep River, near Okotoks, Alta., in 1906–7–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1906.						
June 29	J. F. Hamilton	177.0	398	4.53	3.35	1,806
November 6*	....do	111.0	103	0.84	1.35	86
1907.						
May 11	I. J. Walmsley	75.0	216	2.83	2.40	611
October 8	....do	75.0	194	1.71	2.12	331
1908.						
May 25	P. M. Sauder	114.0	292	3.58	2.86	1,047
May 29	H. R. Carscallen	117.5	306	3.98	3.02	1,216
July 15	....do	123.0	566	0.90	2.25	507
July 29	....do	123.0	520	0.50	1.97	258
August 28	....do	123.0	492	0.32	1.78	155
September 8	....do	116.0	471	0.23	1.64	110
September 29	....do	116.5	481	0.27	1.70	132
1909.						
May 7	H. C. Ritchie	122.0	514	0.84	1.27	432
June 15	J. C. Keith	122.0	728	3.13	3.52	2,283
July 10	....do	122.0	438	2.93	3.45	1,274
July 24	....do	118.5	307	1.28	2.48	394
August 23	....do	108.5	222	0.96	2.00	214
September 16*	....do	52.0	60.5	1.88	1.75	114
October 22*	P. M. Sauder	70.0	74	1.11	1.64	82

*Measurements taken at wading sections.

DAILY Gauge Height and Discharge of Sheep River, near Okotoks, Alta., for 1908.

Day.	April.		May.		June.	
	Gauge. Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.70	130	7.00	6,785
2	.....	.....	1.80	160	7.60	7,685
3	.....	.....	1.90	210	4.90	3,690
4	.....	.....	1.75	145	6.20	5,585
5	2.70	880	1.75	145	5.40	4,415
6	2.00	275	1.85	185	5.70	4,850
7	1.90	210	1.95	242	4.80	3,545
8	1.90	210	2.10	345	4.30	2,825
9	1.90	210	2.50	685	4.00	2,410
10	1.80	160	2.30	505	3.80	2,150
11	1.80	160	2.50	685	3.80	2,150
12	2.00	275	2.45	640	3.60	1,900
13	1.90	210	2.60	780	3.40	1,650
14	1.80	160	2.70	880	3.40	1,650
15	1.50	80	2.90	1,085	3,25	1,477
16	1.60	100	3.70	2,025	3,20	1,420
17	1,60	100	3.50	1,775	3.00	1,190
18	1.60	100	3.10	1,305	2.90	1,085
19	1.60	100	2.90	1,085	2.90	1,085
20	1.80	160	3.40	1,650	3.20	1,420
21	1.80	160	3.10	1,305	3.60	1,900
22	1.60	100	2.90	1,085	3.40	1,650
23	1.60	100	2.90	1,085	3.20	1,420
24	1.60	100	2.80	980	3.00	1,190
25	1.60	100	2.80	980	3.20	1,420
26	1.60	100	2.90	1,085	3.10	1,305
27	1.60	100	3.10	1,305	3.10	1,305
28	1.60	100	3.10	1,305	2.80	980
29	1.65	115	3.00	1,190	2.70	880
30	1.75	145	3.40	1,650	2.70	880
31	.....	.....	4.70	3,400	.....	.....

DAILY Gauge Height and Discharge of Sheep River, near Okotoks, Alta., for 1908—*Con.*.

Day.	July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.60	780	1.90	210	1.80	160	1.80	160
2	2.40	595	1.90	210	1.75	145	2.00	275
3	2.60	780	1.90	210	1.70	130	2.00	275
4	2.50	685	1.90	210	1.70	130	1.90	210
5	2.40	595	1.90	210	1.70	130	1.90	210
6	2.30	505	1.90	210	1.70	130	1.90	210
7	2.30	505	1.85	185	1.70	130	1.90	210
8	2.30	505	1.85	185	1.70	130	1.90	210
9	2.30	505	1.85	185	1.70	130	1.90	210
10	2.30	505	1.85	185	1.65	115	1.90	210
11	2.30	505	1.90	210	1.65	115	1.90	210
12	2.15	385	1.95	242	1.65	115	1.90	210
13	2.20	425	1.95	242	1.65	115	1.90	210
14	2.20	425	1.90	210	1.65	115	1.90	210
15	2.20	425	1.90	210	1.65	115	1.85	185
16	2.30	505	1.90	210	1.65	115	1.85	185
17	2.30	505	1.85	185	1.62	106	1.85	185
18	2.30	505	1.85	185	1.62	106	1.85	185
19	2.30	505	1.80	160	1.62	106	1.80	160
20	2.20	425	1.80	160	1.62	106	1.80	160
21	2.10	345	1.80	160	1.65	115	1.80	160
22	2.10	345	1.80	160	1.60	100	1.80	160
23	2.10	345	1.80	160	1.60	100	1.80	160
24	2.05	310	1.80	160	1.65	115	1.80	160
25	2.00	275	1.80	160	1.70	130	1.80	160
26	2.00	275	1.85	185	1.70	130	1.80	160
27	2.00	275	1.85	185	1.70	130	1.80	160
28	2.00	275	1.80	160	1.70	130	1.80	160
29	2.00	275	1.75	145	1.70	130	1.80	160
30	2.00	275	1.80	160	1.80	160	1.90	210
31	1.90	210	1.80	160	.....	.....	1.90	210

DAILY Gauge Height and Discharge of Sheep River, near Okotoks, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.	Gauge Height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.....	.....	.....	4.15	2,983	3.00	1,082	3.05	862	1.90	156	1.70	98
2.....	.....	.....	4.35	3,212	3.00	1,052	2.90	720	1.90	156	1.70	98
3.....	.....	.....	4.25	3,097	3.00	1,022	2.80	630	1.95	172	1.70	98
4.....	.....	.....	4.00	2,814	3.20	1,200	2.70	544	1.95	172	1.70	98
5.....	.....	.....	3.70	2,480	3.30	1,280	2.80	630	1.95	172	1.70	98
6.....	.....	.....	3.50	2,264	3.70	1,736	2.60	470	1.95	172	1.70	98
7.....	1.70	705	3.30	2,050	4.00	2,116	2.50	404	1.90	156	1.65	85
8.....	2.10	988	3.20	1,946	3.80	1,792	2.50	404	1.80	126	1.65	85
9.....	2.10	988	3.10	1,844	3.50	1,370	2.40	348	1.75	112	1.60	72
10.....	2.25	1,101	3.30	2.050	3.50	1,330	2.40	348	1.75	112	1.65	85
11.....	2.45	1,260	3.50	2,264	3.30	1,110	2.40	348	1.75	112	1.70	98
12.....	2.30	1,140	3.60	2,372	3.20	1,008	2.30	300	1.80	126	1.70	98
13.....	3.25	1,998	3.50	2,264	3.20	1,008	2.20	258	1.75	112	1.65	85
14.....	3.00	1,744	3.40	2,156	3.20	1,008	2.20	258	1.75	112	1.65	85
15.....	3.20	1,946	3.50	2,264	3.10	910	2.20	258	1.75	112	1.65	85
16.....	2.80	1,558	3.60	2,228	3.00	814	2.10	222	1.75	112	1.65	85
17.....	2.80	1,558	3.40	2,088	2.90	720	2.10	222	1.75	112	1.65	85
18.....	2.70	1,470	3.40	2,048	2.90	720	2.10	222	1.80	126	1.65	85
19.....	3.30	2,050	3.50	2,116	2.80	630	2.10	222	1.85	141	1.70	98
20.....	3.50	2,264	3.40	1,974	2.70	544	2.10	222	1.85	141	1.65	85
21.....	3.30	2,050	3.40	1,936	2.60	470	2.00	188	1.85	141	1.65	85
22.....	3.80	2,590	3.20	1,700	2.50	404	2.00	188	1.85	141	1.65	85
23.....	3.50	2,264	3.00	1,484	2.50	404	2.00	188	1.80	126	1.65	85
24.....	4.40	3,270	3.00	1,452	2.45	376	2.00	188	1.75	112	1.65	85
25.....	4.50	3,386	3.00	1,420	2.40	348	1.95	172	1.75	112	1.65	85
26.....	4.00	2,814	3.10	1,474	2.50	404	1.95	172	1.75	112	1.65	85
27.....	4.00	2,814	3.00	1,356	3.35	1,164	2.00	188	1.75	112	1.65	85
28.....	4.40	3,270	3.00	1,172	4.25	2,353	1.95	172	1.75	112	1.65	85
29.....	4.10	2,926	2.90	1,038	3.60	1,448	1.95	172	1.75	112	1.65	85
30.....	3.90	2,702	2.90	1,008	3.40	1,218	1.95	172	1.75	112	1.65	85
31.....	4.10	2,926	.....	.....	3.20	1,008	1.95	172	.....	.....	1.65	85

MONTHLY Discharge of Sheep River, near Okotoks, Alta., for 1908–9.

[Drainage area, 602 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
1908.						
April (5-30)	880	80	173.5	0.288	0.278	8,945
May	3,400	130	968.8	1.609	1.855	59,567
June	7,685	880	2,396.6	3.981	4.441	142,604
July	780	210	444.4	0.738	0.851	27,322
August	210	145	187.4	0.311	0.358	11,522
September	160	100	122.8	0.204	0.228	7,307
October	275	160	191.6	0.318	0.367	11,782
The period	.....	.....	.....	.....	.....	269,049
1909.						
May (7-31)	3,386	705	2,071.3	3.441	3.199	102,708
June	3,212	1,008	2,018.5	3,353	3.741	120,108
July	2,116	348	1,033.8	1.717	1.979	63,568
August	862	172	318.2	0.528	0.609	19,565
September	172	112	130.1	0.216	0.241	7,743
October	98	72	88.4	0.147	0.169	5,433
The period	.....	.....	.....	.....	.....	319,125

HIGHWOOD RIVER AT HIGH RIVER, ALTA.

This station was first established some years ago, by the Irrigation Surveys. It was re-established May 28, 1908, by P. M. Sauder. It is located at the highway bridge in the town of High River.

A plain staff gauge, graduated to feet and tenths, is fastened vertically to the downstream face of the centre pier. It is referred to bench marks as follows:—(1) top of crib pier to which the gauge height is fixed, elevation 10.41; (2) top of crib abutment on left bank, elevation 10.40; (3) southwest corner of concrete pier supporting north end of C.P.R. bridge elevation 8.38.

The channel is straight for about 300 feet above and below the station. The right bank is low and liable to overflow. It is composed of gravel and sand and covered with brush. The left bank is low but is protected from overflow by a crib work. The current is swift in high stages of the stream, but is sluggish in low water.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inside edge of the crib abutment, supporting the north end of the bridge. Distances are marked on the bottom cord of the bridge at every five feet from the initial point. There is an eddy about the centre pier and special care must be exercised by the hydrographer in making discharge measurements at this station. At extreme low water, a check measurement is made at a wading section about 300 yards below the bridge.

At a point about half a mile above this station, the Little Bow ditch, operated by the Provincial Government diverts water from Highwood River into the head of the Little Bow River. The diverting dam has been so damaged that during the past two years, water could only be diverted in the higher stages of the river, and even then only a very small amount of water was diverted.

During the flood in 1908, Highwood River overflowed its left bank above the town. This water was dammed by the Canadian Pacific railroad grade running north from High

River. After flooding several hundred acres of agricultural land it broke through the railroad grade and reached the river some distance below the town. To prevent a repetition of this occurrence, a highwater overflow channel has been constructed from the Lineham Mill Pond, to the river. The water through this overflow does not pass the gauging station There was no excessive high water during 1909, but during the latter part of the summer there was a small flow through the overflow channel, caused by the mill company raising the water in their pond, to float logs. Miscellaneous discharge measurements of the flow at the spillway, at the head of this channel and of the flow of the Little Bow ditch were made on the same days as Highwood River was measured at the regular station.

The observations of the daily gauge height, on Highwood River, at High River, have been made by F. H. Holmes, since August 1, 1908.

DISCHARGE Measurements of Highwood River, at High River, Alta., in 1906-7-8-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 5	J. F. Hamilton	147	444	3.18	3.00	1,411
1907.						
May 30	I. J. Walmsley	147	497	3.35	3.50	1,664
October 2	....do	147	359	2.30	.....	823
1908.						
May 28	H. R. Carscallen	149	539	3.05	3.65	1,643
June 9	....do	154	885	5.77	5.92	4,891
July 14	....do	146.5	523	1.75	3.45	912
July 31	....do	136.0	413	1.04	2.76	432
August 27	....do	92.5	374	0.74	2.465	277
September 9	....do	89.0	360	0.54	2.265	194
September 28	....do	89.5	358	0.56	2.28	201
1909.						
May 8	H. C. Ritchie	94.0	371	1.04	2.58	348
June 16	J. C. Keith	151.0	702	4.67	4.89	3,281
July. 12	....do	149.5	515	2.77	3.69	1,428
July 26†	....do	120.8	417	1.71	2.98	715
August 21†	....do	90.5	375	1.22	2.55	458
September 16†	....do	84.3	344	0.83	2.20	286
October 22*	P. M. Sauder	92.0	89	1.63	2.05	145

*Measurement taken at wading section.
†Measurements are too high owing to back water.

DAILY Gauge Height and Discharge of Highwood River, at High River, for 1908.

Day.	June.		July.		August.		September.		October.	
	Gauge Height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	5.60	4,320	.....	.....	2.75	432	2.45	272	2.45	272
2	8.30	9,180	.....	.....	2.80	460	2.35	228	2.50	295
3	7.60	7,920	.....	.....	2.75	433	2.35	227	2.55	322
4	6.60	6,120	.....	.....	2.70	405	2.30	205	2.50	295
5	7.00	6.840	.....	.....	2.65	377	2.30	205	2.40	250
6	6.80	6,480	.....	.....	2.65	378	2.25	188	2.35	228
7	6.10	5,220	.....	.....	2.60	350	2.25	187	2.40	250
8	5.90	4,860	.....	.....	2.60	350	2.25	188	2.35	227
9	5.70	4,500	.....	.....	2.60	350	2.25	187	2.35	228
10	5.60	4,320	.....	.....	2.60	350	2.25	188	2.35	227
11	5.40	3,960	.....	.....	2.60	350	2.30	205	2.35	228
12	5.10	3,420	.....	.....	2.70	405	2.25	187	2.35	227
13	5.10	3,420	.....	.....	2.70	405	2.25	188	2.35	228
14	5.00	3,240	.....	.....	2.65	377	2.20	170	2.40	250
15	4.90	3,060	.....	.....	2.65	378	2.20	170	2.45	272
16	4.90	3,060	.....	.....	2.60	350	2.15	160	2.40	250
17	4.70	2,705	.....	.....	2,55	322	2.20	170	2.40	250
18	4.70	2,705	.....	.....	2.50	295	2.25	187	2.35	228
19	4.60	2,530	.....	.....	2.50	295	2.25	188	2.15	160
20	5.70	4,500	.....	.....	2.45	272	2.20	170	2.25	187
21	5.85	4,770	.....	.....	2.50	295	2.20	170	2.30	205
22	4.75	2,792	.....	.....	2.60	350	2.20	170	2.15	160
23	4.65	2,618	.....	.....	2.50	295	2.20	170	2.20	170
24	4.50	2,365	.....	.....	2.50	295	2.35	227	2.15	160
25	4.60	2,530	.....	.....	2.60	350	2.35	228	2.15	160
26	4.65	2,618	.....	.....	2.50	295	2.35	227	2.20	170
27	4.50	2,365	.....	.....	2.45	273	2.30	205	2.20	170
28	.....	.....	.....	.....	2.40	250	2.30	205	2.25	188
29	.....	.....	.....	.....	2.40	250	2.30	205	2.25	187
30	.....	.....	.....	.....	2.50	295	2.25	188	2.30	205
31	.....	.....	.....	.....	2.55	322	.....	.....	2.30	205

NOTE.—No observer from June 28th to July 31st.
Rating curve is not well defined above gauge height, 6.10.

DAILY Gauge Height and Discharge of Highwood River, at High River, Alta., for 1909.

Day.	April.		May.		June.	
	Gauge Height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	1.95	130	2.30	240	5.00	3,465
2	1.90	120	3.00	710	5.50	4,315
3	1.95	130	3.40	1,095	5.55	4,400
4	1.85	115	3.50	1,205	5.10	3,635
5	1.85	115	2.80	545	4.60	2,800
6	1.90	120	2.70	475	4.55	2,720
7	1.90	120	2.60	405	4.35	2,400
8	1.85	115	2.60	405	4.30	2,320
9	1.90	120	2.60	405	4.15	2,085
10	1.85	115	2.60	405	4.10	2,010
11	1.90	120	3.00	710	4.50	2,640
12	1.85	115	2.65	440	4.70	2,965
13	1.90	120	3.10	800	4.80	3,130
14	2.00	140	3.00	710	4.80	3,130
15	2.10	165	3.40	1,095	4.80	3,130
16	2.10	165	3.20	895	4.80	3,130
17	2.20	200	2.90	625	4.80	3,130
18	2.30	240	2.90	625	4.80	3,130
19	2.30	240	3.10	800	4.75	3,047
20	2.20	200	3.70	1,445	4.70	2,965
21	2.20	200	3.80	1,575	4.60	2,800
22	2.10	165	4.30	2,320	4.50	2,640
23	2.10	165	5.20	3,805	4.25	2,240
24	2.20	200	5.15	3,720	4.10	2,010
25	2.40	290	5.05	3,550	4.00	1,860
26	2.45	317	4.90	3,295	4.00	1,860
27	2.50	345	4.90	3,295	3.70	1,445
28	2.55	375	4.90	3,295	3.70	1,445
29	2.40	290	4.90	3,295	3.60	1,320
30	2.50	345	4.85	3,212	3.65	1,382
31	.....	.....	4.85	3,212	.....	.....

DAILY Gauge Height and Discharge of Highwood River, at High River, for 1909—*Con.*

Day.	July.		August.		September.		October.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	4.15	2,085	3.50	1,205	2.40	290	2.05	153
2	4.20	2,160	3.40	1,095	2.35	265	2.00	140
3	4.10	2,010	3.30	995	2.35	265	2.05	152
4	4.15	2,085	3.25	945	2.35	265	2.05	153
5	4.00	1,860	3.15	847	2.35	265	2.00	140
6	4.40	2,480	3.05	755	2.35	265	2.05	152
7	4.70	2,965	3.00	710	2.35	265	2.05	153
8	4.10	2,010	2.95	667	2.35	265	2.05	152
9	4.00	1,860	2.95	667	2.35	265	2.00	140
10	3.90	1,715	2.90	625	2.30	240	2.05	153
11	3.70	1,445	2.85	585	3.35	265	2.05	152
12	3.60	1,320	2.80	545	2.35	265	2.05	153
13	3.50	1,205	2.80	545	2.30	240	2.00	140
14	3.65	1,382	2.75	510	2.25	220	2.00	140
15	3.40	1,095	2.75	510	2.25	220	2.05	152
16	3.35	1,045	2.70	475	2.25	220	2.00	140
17	3.30	995	2.65	440	2.20	200	2.00	140
18	3.15	847	2.65	440	2.20	200	2.00	140
19	3.05	755	2.60	405	2.20	200	2.05	153
20	3.05	755	2.55	375	2.15	182	2.05	152
21	3.00	710	2.55	375	2.20	200	2.00	140
22	3.05	755	2.55	375	2.25	220	2.00	140
23	3.00	710	2.50	345	2.20	200	2.00	140
24	2.95	667	2.50	345	2.25	220	2.00	140
25	3.01	719	2.45	317	2.30	240	2.05	153
26	3.50	1,205	2.45	318	2.10	165	2.05	152
27	3.80	1,575	2.45	317	2.00	140	2.00	140
28	4.80	3,130	2.45	318	2.00	140	2.00	140
29	4.30	2,320	2.45	317	2.05	152	2.00	140
30	3.90	1,715	2.45	318	2.10	165	2.00	140
31	3.70	1,445	2.40	290	.....	.....	2.00	140

MONTHLY Discharge of Highwood River, at High River, Alta., for 1908–9.

[Drainage area, 735 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square. mile.	Depth in inches on Drainage. area.	Total in acre-feet.
1908.						
June (1-27)	9,180	2,365	4,163.6	5.665	5.688	222,978
July	.....	.....	.....	.....	.....	.....
August	460	250	342.1	0.465	0.536	21,033
September	272	160	195.5	0.266	0.297	11,633
October	322	160	221.1	0.301	0.347	13,595
The period	.....	.....	.....	.....	....	269,239
1909.						
April	375	115	186.6	0.254	0.283	11,101
May	3,805	240	1,568.1	2.133	2.459	96,420
June	4,400	1,320	2,651.6	3.607	4.025	157,786
July	2,965	667	1,516	2.064	2.379	93,273
August	1,205	290	547.6	0.745	0.859	33,671
September	290	140	223.5	0.304	0.339	13,297
October	153	140	145.6	0.198	0.228	8,955
The period	.....	.....	.....	.....	.....	414,503

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements of Little Bow Ditch, at High River, Alta., in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft6*
July 12	J. C. Keith	Near intake	11.5	8.3	7.08
July 26	....do	....do	.....	.....	Nil.
August 21	....do	....do	.....	.....	Nil.
September 16	....do	....do	.....	.....	Nil.
October 22	P. M. Sauder	....do	.....	.....	Nil.

MISCELLANEOUS Discharge Measurements of Spillway at Lineham's Lumber Mill, at High River, Alta., in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
July 26	J. C. Keith	At C.P.R. culvert	3.0	4.7	15.6
August 21	....do	....do	4.5	2.07	5.6
September 16	.. do	....do	3.0	1.0	.8
October 22	P. M. Sauder	....do	.....	.....	Nil.

MISCELLANEOUS Discharge Measurements of Tongueflag Creek, near High River, Alta., in 1908–9.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
1908.					
May 30	H. R. Carscallen	Sec. 19-19-28-4	16.	16.2	30.2
July 30	....do	....do	15.	12.8	12.3
August 27	....do	....do	14.5	12.6	12.1
September 9	....do	....do	14.0	10.8	6.6
September 29	H. C. Ritchie	....do	14.0	13.4	16.0
1909.					
May 7	H. C. Ritchie	....do	15.0	14.3	18.2
June 18	J. C. Keith	....do	12.0	9.5	12.1
July 10	....do	....do	12.0	13.7	27.8
July 24	....do	....do	12.0	6.1	2.4
August 21	....do	....do	4.0	1.1	0.8

MISCELLANEOUS Discharge Measurements of Highwood River, at Traffic Bridge, on Section 18, Township 20, Range 28, west of the 4th Meridian, near Aldersyde, Alta., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
		Feet.	*Sq. ft.*	*Sec.-ft.*
July 14	H. R. Carscallen	169.5	330	923
July 30	....do	148.5	249	463
August 27	....do	138.	195	302
September 9	....do	132.5	167	201
September 29	....do	133.	.....	231

MOSQUITO CREEK, NEAR NANTON, ALTA.

This station was established August 1, 1908, by H. C. Ritchie. It is located at the traffic bridge, about four miles from Nanton, on the road from Nanton to Cayley. The bridge is on a road diversion on Section 30, Township 16, Range 28 west of the 4th Meridian.

A plain staff gauge, graduated to feet and hundredths, was at first driven about twenty feet upstream from the bridge, in the bed of the stream at the right bank and stayed to posts driven in the bank. This location was not altogether suitable, being on the opposite side of the stream from the observer and the hole about the gauge was continually filling in with sand and mud. During the winter the gauge was disturbed by frost. On July 7, 1909, Mr. Ritchie re-established the gauge on the opposite bank of the stream and built a plank crib about it and the difficulties above mentioned have been almost overcome. The gauge is referred to two spike heads in the south side of the bridge pier at the right bank of the stream.

The channel is straight for about 175 feet below the station, then curves to the left. Above the station the channel curves slightly to the left for about 500 feet, then it turns sharply to the left. Right bank is low at water's edge but high a few feet from it. Sand and mud deposit on this bank in high water. The left bank is high and is of solid clay with a few boulders. There is only one channel at low water. The bridge piers divide the stream into three channels at flood stage.

Discharge measurements are made from the bridge at high water and flood stages. The initial point for soundings is the north end of the bridge. The current is very sluggish at the bridge during low water and during this stage, discharge measurements should be made at a wading section, a distance above or below the bridge.

The gauge was read daily by A. J. Clever, who lives about 1,200 feet north of the bridge.

Discharge Measurements of Mosquito Creek near Nanton, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq.-ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1908.						
July 13	H. R. Carscallen	41.0	107.0	0.86	.....	92.1
August 1	....do	21.0	18.5	3.04	3.07	56.2
August 26*	....do	18.5	13.4	2.60	2.93	34.8
September 10*	....do	18.0	11.6	2.38	2.85	27.6
September 28*	....do	18.5	14.5	2.54	2.94	37.0
1909.						
May 10*	H. C. Ritchie	17.5	12.0	2.05	2.71	25.0
May 29	P. M. Sauder	42.5	103.0	1.14	3.25	119.0
June 17†	J. C. Keith	36.5	74.0	0.43	2.76	32.0
July 6	H. C. Ritchie	38.5	75.5	2.43	3.45	184.0
July 27†	J. C. Keith	37.0	75.0	0.33	2.865	25.0
August 27*	....do	14.5	7.2	0.94	2.55	6.7
September 14*	....do	6.5	3.2	1.76	2.51	5.6
October 22*	A. W. Pae	6.8	3.8	2.16	2.58	8.2

†Measurements too large, being taken at the bridge when the velocity was too low.
*Measurements taken at wading sections..

Daily Gauge Height and Discharge of Mosquito Creek, near Nanton, Alta., for 1908.

Day.	July.		August.		September.		October.	
	Gauge.. height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.06	54.8	2.92	34.4	2.85	26.0
2	.....	.....	3.05	53.0	2.88	29.6	2.96	39.4
3	.....	.....	3.04	51.4	2.85	26.0	2.97	40.8
4	.....	.....	3.05	53.0	2.84	25.0	2.92	34.4
5	.....	.....	3.03	49.8	2.83	24.0	2.86	27.2
6	.....	.....	3.02	48.2	2.82	23.0	2.88	29.6
7	.....	.....	3.02	48.2	2.80	21.0	2.85	26.0
8	.....	.....	3.09	60.2	2.78	19.4	2.84	25.0
9	.....	.....	3.02	48.2	2.84	25.0	2.79	20.2
10	.....	.....	3.00	45.0	2.84	25.0	2.79	20.2
11	.....	.....	3.00	45.0	2.80	21.0	2.78	19.4
12	.....	.....	3.15	72.0	2.79	20.2	2.78	19.4
13	.....	.....	3.09	60.2	2.78	19.4	2.75	17.0
14	.....	.....	3.02	48.2	2.76	17.8	2.80	21.0
15	.....	.....	3.02	48.2	2.76	17.8	2.92	34.4
16	.....	.....	2.99	43.6	2.78	19.4	2.91	33.2
17	.....	.....	2.99	43.6	2.80	21.0	2.80	21.0
18	.....	.....	2.96	39.4	2.84	25.0	2.78	19.4
19	.....	.....	2.95	38.0	2.84	25.0	2.78	19.4
20	.....	.....	2.92	34.4	2.82	23.0	2.80	21.0
21	.....	.....	2.93	35.6	2.86	27.2	2.87	28.4
22	.....	.....	2.95	38.0	2.86	27.2	2.85	26.0
23	.....	.....	2.93	35.6	2.85	26.0	2.86	27.2
24	.....	.....	2.95	38.0	2.82	23.0	2.80	21.0
25	.....	.....	2.94	36.8	2.90	32.0	2.78	19.4
26	.....	.....	2.92	34.4	2.92	34.4	2.77	18.6
27	.....	.....	2.89	30.8	2.91	33.2	2.78	19.4
28	.....	.....	2.89	30.8	2.93	35.6	2.79	20.2
29	.....	.....	2.88	29.6	2.93	35.6	2.79	20.2
30	.....	.....	2.91	33.2	2.92	34.4	2.80	21.0
31	.....	.....	2.94	36.8	.....	.....	2.85	26.0

DAILY Gauge Height and Discharge of Mosquito Creek, near Nanton, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.....	3.10	82.0	3.00	62.0	2.65	13.5	2.70	18.0	2.51	5.8	2.49	5.3
2.....	3.15	93.5	2.95	53.0	2.64	12.6	2.70	18.0	2.51	5.8	2.49	5.3
3.....	2.87	39.8	2.94	51.2	2.64	12.6	2.67	15.3	2.50	5.5	2.50	5.5
4.....	2.87	39.8	2.93	49.4	2.63	11.7	2.66	14.4	2.54	6.9	2.50	5.5
5.....	2.87	39.8	2.95	53.0	3.00	62.0	2.70	18.0	2.55	7.2	2.50	5.5
6.....	2.87	39.8	2.96	54.8	3.40	165.0	2.66	14.4	2.52	6.2	2.50	5.5
7.....	2.75	24.0	2.94	51.2	3.40	165.0	2.65	13.5	2.49	5.3	2.52	6.2
8.....	2.74	22.8	2.94	51.2	3.04	70.0	2.65	13.5	2.48	5.2	2.51	5.8
9.....	2.73	21.6	2.94	51.2	3.03	68.0	2.65	13.5	2.48	5.2	2.50	5.5
10.....	2.73	21.6	2.93	49.4	2.95	53.0	2.61	9.9	2.47	5.0	2.51	5.8
11.....	3.16	95.8	2.89	42.6	2.85	37.0	2.61	9.9	2.50	5.5	2.55	7.2
12.....	3.17	98.1	2.92	47.6	2.84	35.6	2.60	9.0	2.50	5.5	2.55	7.2
13.....	3.45	184.0	2.81	31.4	2.85	37.0	2.56	7.6	2.50	5.5	2.55	7.2
14.....	3.20	105.0	2.82	32.8	2.85	37.0	2.55	7.2	2.50	5.5	2.56	7.6
15.....	3.00	62.0	2.80	30.0	2.81	31.4	2.54	6.9	2.49	5.3	2.55	7.2
16.....	3.16	95.8	2.75	24.0	2.75	24.0	2.54	6.9	2.47	5.0	2.55	7.2
17.....	3.05	72.0	2.71	19.2	2.74	22.8	2.55	7.2	2.50	5.5	2.55	7.2
18.....	3.22	110.0	2.73	21.6	2.73	21.6	2.52	6.2	2.51	5.8	2.56	7.6
19.....	3.22	110.0	2.73	21.6	2.70	18.0	2.53	6.5	2.50	5.5	2.58	8.3
20.....	3.63	255.0	2.74	22.8	2.70	18.0	2.51	5.8	2.52	6.2	2.57	7.9
21.....	3.60	242.0	2.87	39.8	2.69	17.1	2.51	5.8	2.56	7.6	2.57	7.9
22.....	3.33	142.0	2.73	21.6	2.70	18.0	2.54	6.9	2.53	6.5	2.57	7.9
23.....	4.60	677.0	2.70	18.0	2.66	14.4	2.52	6.2	2.55	7.2	2.57	7.9
24.....	5.15	931.0	2.72	20.4	2.65	13.5	2.50	5.5	2.55	7.2	2.56	7.6
25.....	3.90	368.0	2.80	30.0	2.65	13.5	2.50	5.5	2.53	6.5	2.57	7.9
26.....	3.40	165.0	2.75	24.0	2.72	20.4	2.51	5.8	2.50	5.5	2.57	7.9
27.....	3.34	145.0	2.65	13.5	3.04	70.0	2.54	6.9	2.50	5.5	2.57	7.9
28.....	3.20	105.0	2.65	13.5	3.10	82.0	2.53	6.5	2.52	6.2	2.56	7.6
29.....	3.24	116.0	2.64	12.6	2.93	49.4	2.55	7.2	2.49	5.3	2.58	8.3
30.....	3.07	76.0	2.65	13.5	2.83	34.2	2.53	6.5	2.48	5.2	2.59	8.6
31.....	3.00	62.0	.....	.....	2.83	34.2	2.52	6.2	.....	.....	2.57	7.9

MONTHLY Discharge of Mosquito Creek, near Nanton, Alta., for 1908–9.

[Drainage area, 178 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square. mile.	Depth in inches on Drainage. area.	Total in acre-feet.
1908.						
August.....	72.0	29.6	44.00	0.247	0.285	2,705
September.....	35.6	17.8	25.69	0.144	0.161	1,528
October.....	40.8	17.0	24.56	0.138	0.159	1,510
The period.....	.....	.....	.....	.....	.....	5,743
1909.						
May.....	931.0	21.6	149.7	0.841	0.969	9.208
June.....	62.0	12.6	34.2	0.192	0.214	2.037
July.....	165.0	11.7	41.4	0.232	0.267	2,544
August.....	18.0	5.5	9.4	0.052	0.060	577
September.....	7.6	5.0	5.9	0.033	0.037	349
October.....	8.6	5.3	7.0	0.039	0.045	432
The period.....	.....	.....	.....	.....	.....	15,147

Nanton Creek, near Nanton, Alta.

This station was established August 3, 1908, by P. M. Sauder. It is located at George Topper's farm, near Nanton. It is on Section 20, Township 16, Range 28 west of the 4th Meridian and almost directly west of Mr. Topper's stable.

The gauge, which is a plain staff, graduated to feet and hunrdedths is driven vertically into the bed of the stream, at the left bank. It is attached by braces to posts in the bank. The bench mark is the top of a hub (wood stake with iron cap) on the right bank, about 75 feet southeast from the gauge; elevation 17.82 above the zero of the gauge.

This stream follows a very crooked course, but the channel is nearly straight for about 125 feet above the gauge and for about 75 feet below. The banks are well defined but not high and may overflow in excessive floods. The banks are composed of clay and covered with tough sod. The bed of the stream is composed of gravel, not liable to shift and free from vegetation.

Discharge measurements are made by wading at or near the gauge. At flood stage discharge measurements may be made at Mr. Topper's bridge, about 1,000 feet downstream from the gauge.

The gauge was read once each day by Mr. George Topper.

Discharge Measurements of Nanton Creek, near Nanton, Alta., in 1908–09.

Date.	Hydrographer.	Width.	Area of Section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 13	H. R. Carscallen	12.5	30.0	1.21	.....	36.5
August 3	....do	6.8	7.4	2.06	5.95	15.3
August 26	....do	9.0	6.1	1.33	5.69	8.17
September 10	....do	9.0	6.2	1.15	5.65	7.11
September 28	P. M. Sauder	8.5	8.2	1.44	5.83	11.8
1909.						
May 10	H. C. Ritchie	8.4	6.6	1.40	5.55	9.23
May 29	P. M. Sauder	8.3	14.3	2.73	6.41	39.0
June 17	J. C. Keith	8.6	8.8	1.67	5.76	14.7
July 6	H. C. Ritchie	8.4	10.5	2.15	6.00	22.5
July 27	J. C. Keith	8.6	10.9	2.02	5.985	21.9
August 27	....do	8.5	3.6	0.93	5.23	3.36
September 14	....do	8.6	3.2	0.63	5.20	2.03
October 22	A. W. Pae	8.7	3.3	0.72	5 26	2.37

DAILY Gauge Height and Discharge of Nanton Creek, near Nanton, Alta., for 1908.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	5.75	9.7	5.70	8.4
2	.....	.....	5.70	8.4	5.90	13.8
3	5.95	15.3	5.68	7.9	5.85	12.4
4	6.00	16.8	5.65	7.2	5.80	11.0
5	5.95	15.3	5.65	7.2	5.80	11.0
6	6.03	17.7	5.65	7.2	5.85	12.4
7	5.95	15.3	5.65	7.2	5.85	12.4
8	6.03	17.7	5.65	7.2	5.83	11.8
9	5.95	15.3	5.67	7.7	5.80	11.0
10	5.93	14.7	5.68	7.9	5.78	10.5
11	5.91	14.1	5.65	7.2	5.75	9.7
12	6.13	21.0	5.65	7.2	5.70	8.4
13	6.03	17.7	5.65	7.2	5.70	8.4
14	5.95	15.3	5.65	7.2	5.68	7.9
15	5.90	13.8	5.65	7.2	5.75	9.7
16	5.90	13.8	5.65	7.2	5.70	8.4
17	5.87	12.9	5.67	7.7	5.68	7.9
18	5.85	12.4	5.67	7.7	5.65	7.2
19	5.80	11.0	5.67	7.7	5.65	7.2
20	5.80	11.0	5.66	7.4	5.65	7.2
21	5.78	10.5	5.65	7.2	5.98	16.2
22	5.77	10.2	5.65	7.2	5.88	13.2
23	5.75	9.7	5.65	7.2	5.80	11.0
24	5.90	13.8	5.66	7.4	5.75	9.7
25	5.78	10.5	5.75	9.7	5.70	8.4
26	5.69	8.2	5.80	11.0	5.68	7.9
27	5.69	8.2	5.83	11.8	5.65	7.2
28	5.69	8.2	5.83	11.8	5.65	7.2
29	5.70	8.4	5.80	11.0	5.65	7.2
30	5.75	9.7	5.78	10.5	5.70	8.4
31	5.90	13.8	.....	.....	5.75	9.7

DAILY Gauge Height and Discharge of Nanton Creek, near Nanton, Alta, for 1909.

Day.	May.		June		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.....	6.24	31.7	6.10	26.2	5.65	11.7	5.45	6.8	5.20	2.0	5.15	1.2
2.....	6.40	38.5	6.00	22.5	5.60	10.5	5.40	5.7	5.20	2.0	5.15	1.2
3.....	6.70	52.5	6.00	22.5	5.60	10.5	5.40	5.7	5.20	2.0	5.15	1.2
4.....	6.60	47.5	6.00	22.5	5.70	13.0	5.40	5.7	5.20	2.0	5.15	1.2
5.....	5.75	14.5	6.50	43.0	6.90	62.7	5.45	6.8	5.20	2.0	5.20	2.0
6.....	5.70	13.0	6.15	28.1	6.60	47.5	5.40	5.7	5.20	2.0	5.15	1.2
7.....	5.55	9.2	6.15	28.1	6.85	60.1	5.40	5.7	5.20	2.0	5.20	2.0
8.....	5.60	10.5	6.10	26.2	6.40	38.5	5.40	5.7	5.20	2.0	5 20	2.0
9.....	5.55	9.2	6.05	24.3	5.90	19.0	5.40	5.7	5.15	1.2	5.20	2.0
10.....	5.50	8.0	5.95	20.7	5.70	13.0	5.40	5.7	5.15	1.2	5.25	2.8
11.....	6.15	28.1	5.95	20.7	5.70	13.0	5.35	4.7	5.20	2.0	5.25	2.8
12.....	6.10	26.2	5.95	20.7	5.70	13.0	5.35	4.7	5.25	2.8	5.25	2.8
13.....	6.50	43.0	5.95	20.7	5.70	13.0	5.30	3.7	5.25	2.8	5.25	2.8
14.....	6.00	22.5	5.90	19.0	5.70	13.0	5.30	3.7	5.25	2.8	5.25	2.8
15.....	6.35	36.3	5.85	17.5	5.60	10.5	5.30	3.7	5.20	2.0	5.25	2.8
16.....	6.10	26.2	5.75	14.5	5.55	9.2	5.30	3.7	5.15	1.2	5.25	2.8
17.....	6.20	30.0	5.75	14.5	5.50	8.0	5.25	2.8	5.15	1.2	5.25	2.8
18.....	6.70	52.5	5.75	14.5	5.50	8.0	5.25	2.8	5.15	1.2	5.25	2.8
19.....	6.50	43.0	5.75	14.5	5.50	8.0	5.25	2.8	5.20	2.0	5.25	2.8
20.....	6.65	50.0	5.85	17.5	5.50	8.0	5.25	2.8	5.25	2.8	5.25	2.8
21.....	6.55	45.2	5.85	17.5	5.45	6.8	5.20	2.0	5.25	2.8	5.25	2.8
22.....	7.10	73.5	5.85	17.5	5.45	6.8	5.20	2.0	5.25	2.8	5.25	2.8
23.....	7.45	94.0	5.80	16.0	5.45	6.8	5.20	2.0	5.25	2.8	5.25	2.8
24.....	8.00	127.0	5.75	14.5	5.45	6.8	5.20	2.0	5.25	2.8	5.25	2.8
25.....	6.90	62.7	6.00	22.5	5.45	6.8	5.20	2.0	5.15	1.2	5.25	2.8
26.....	6.85	60.1	5.80	16.0	5.45	6.8	5.25	2.8	5.15	1.2	5.25	2.8
27.....	6.55	45.3	5.75	14.5	5.95	20.7	5.25	2.8	5.15	1.2	5.25	2.8
28.....	6.50	43.0	5.70	13.0	6.00	22.5	5.25	2.8	5.15	1.2	5.25	2.8
29.....	6.40	38.5	5.70	13.0	5.60	10.5	5.30	3.7	5.15	1.2	5.30	3.7
30.....	6.30	34.2	5.70	13.0	5.50	8.0	5.25	2.8	5.15	1.2	5.30	3.7
31.....	6.20	30.0	.....	.....	5.50	8.0	5.25	2.8	.....	.....	5.30	3.7

MONTHLY Discharge of Nanton Creek, near Nanton, Alta., for 1908–9.

[Drainage area, 41 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
August (3–31).....	21.0	8.2	13.2	0.321	0.246	758
September.....	11.8	7.2	8.2	0.200	0.223	488
October.....	16.2	7.2	9.8	0.238	0.274	600
The period.....	.....	.....	.....	.....	.....	1,846
1909.						
May.....	127.	8.	40.2	0.980	1.130	2.471
June.....	43.	13.	19.9	0.484	0.540	1,182
July.....	62.7	6.8	16.2	0.394	0.454	993
August.....	6.8	2.	3.9	0.096	0.111	242
September.....	2.8	1.2	1.9	0.047	0.052	114
October.....	3.7	1.2	2.5	0.061	0.070	155
The period.....	.....	.....	.....	.....	.....	5,157

Willow Creek, at New Oxley, Alta.

A gauging station was established here by H. C. Ritchie, on the 6th of August, 1908.

The gauge rod, which is a plain staff, graduated to feet and hundredths, is located at the right bank of the stream, about 100 yards from Mr. F. W. Elliott's house. It is referenced by a bench mark, made by driving two spikes into a fence post, at a distance of 25 feet northwest of the gauge; elevation 12.10.

The discharge measurements are made at a wading section, 500 yards upstream. Above this station the stream is straight for about 100 feet, where it is divided by an island. Another island is formed 200 feet below. The stream is inclined to be sluggish, particularly above the wading section. The bed is of sand and shifty. The right bank is high and clean while the left is low and liable to be overflowed during flood stage.

The bed and banks shift almost continuously during high and flood stages of the stream and during those periods the results at this station were likely to be more or less unsatisfactory. Early in the season of 1909, the gauge was carried away by a freshet and it was then decided to abandon this station and to establish a new station near Macleod, Alta.

Discharge Measurements of Willow Creek, at New Oxley, P.O., Alta., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 7	H. R. Carscallen	64.5	44.7	2.55	2.70	114.
August 25	....do	60.0	35.0	2.50	2.56	87.3
September 11	....do	44.5	24.0	2.05	2.35	49.1
September 23	....do	44.0	23.5	2.02	2.32	47.4

DAILY Gauge Height and Discharge of Willow Creek, at New Oxley, P.O., Alta., for 1908.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.5	75.5	2.6	94
2	.....	.....	2.5	75.5	2.6	94
3	.....	.....	2.5	75.5	2.7	114
4	.....	.....	2.5	75.5	2.6	94
5	.....	.....	2.4	58	2.6	94
6	2.7	114	2.4	58	2.5	75.5
7	2.7	114	2.4	58	2.5	75.5
8	2.7	114	2.4	58	2.5	75.5
9	2.7	114	2.4	58	2.5	75.5
10	2.6	94	2.4	58	2.5	75.5
11	2.6	94	2.4	58	2.5	75.5
12	2.8	135	2.4	58	2.5	75.5
13	2.8	135	2.3	44.5	2.5	75.5
14	2.7	114	2.3	44.5	2.5	75.5
15	2.7	114	2.3	44.5	2.5	75.5
16	2.7	114	2.3	44.5	2.4	58
17	2.6	94	2.3	44.5	2.4	58
18	2.6	94	2.3	44.5	2.4	58
19	2.6	94	2.3	44.5	2.4	58
20	2.6	94	2.3	44.5	2.4	58
21	2.6	94	2.3	44.5	2.4	58
22	2.6	94	2.3	44.5	2.4	58
23	2.6	94	2.3	44.5	2.4	58
24	2.6	94	2.4	58	2.4	58
25	2.6	94	2.4	58	2.4	58
26	2.6	94	2.4	58	2.4	58
27	2.5	75.5	2.4	58	.....	.....
28	2.5	75.5	2.5	75.5	.....	.....
29	2.5	75.5	2.5	75.5	.....	.....
30	2.5	75.5	2.5	75.5	.....	.....
31	2.5	75.5	.....	.....	.....	.....

MONTHLY Discharge of Willow Creek, at New Oxley, P.O., Alta., for 1908.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
August (6–31)	135	75.5	98.98	.....	.....	5,104
September	75.5	44.5	57.13	.....	.....	3,400
October (1–26)	114	58	72.42	.....	.....	3,735
The period	.....	.....	.....	.....	.....	12,239

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Willow Creek, at traffic bridge, on south of Section 6, Township 11, Range 26 west of the 4th Meridian, near Granum, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Sec.-ft.*
July 8	H. R. Carscallen	208	374	698
1909.				
June 7	H. C. Ritchie	195.5	393	906

Trout Creek, at Labute's Ranche.

This gauging station, which is situated on John Labute's ranch, Section 33, Township 11, Range 28 west of the 4th Meridian, was established by H. C. Ritchie, on July 28, 1908.

The gauge which is a plain staff graduated to feet and hundredths, is located on the right bank of the stream, within 180 feet of Mr. Labute's house. It is referenced by a bench mark placed on a tree about 25 yards downstream; elevation 7.80.

The channel is straight for 90 feet above and 60 feet below the gauge. The bed is rocky and clean and is in one channel. The right bank is low for about 20 feet, when it rises abruptly. The left bank is low and sandy and is overflowed in high water. Both banks are wooded.

The discharge measurements on this creek, were taken at a wading section, three feet below the gauge; the initial point for soundings being marked on a tree on the right bank.

The daily gauge height was read by Mr. John Labute.

Discharge Measurements of Trout Creek, at Labute's Ranche, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 5	H. R. Carscallen	28.0	26.3	2.18	1.42	57.2
August 25	....do	27.0	19.6	2.32	1.21	45.5
September 11	....do	25.5	14.4	1.88	1.04	27.1
September 22	....do	23.5	12.8	1.83	0.985	23.3
1909.						
May 14	H. C. Ritchie	27.0	18.8	2.06	1.15	38.7

Daily Gauge Height and Discharge of Trout Creek, at Labute's Ranche, for 1908.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.5	64	1.1	31.5	1.1	31.5
2	.....	.....	1.5	64	1.1	31.5	1.1	31.5
3	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
4	.....	.....	1.3	47.5	1.1	51.5	1.1	31.5
5	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
6	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
7	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
8	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
9	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
10	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
11	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
12	.....	.....	1.5	64	1.1	31.5	1.1	31.5
13	.....	.....	1.5	64	1.1	31.5	1.1	31.5
14	.....	.....	1.3	47.5	1.1	31.5	1.1	31.5
15	.....	.....	1.3	47.5	1.1	31.5	1.0	24
16	.....	.....	1.3	47.5	1.1	31.5	1.0	24
17	.....	.....	1.3	47.5	1.1	31.5	1.0	24
18	.....	.....	1.3	47.5	1.1	31.5	1.0	24
19	.....	.....	1.3	47.5	1.1	31.5	1.0	24
20	.....	.....	1.3	47.5	1.1	31.5	1.0	24
21	.....	.....	1.3	47.5	1.1	31.5	1.0	24
22	.....	.....	1.3	47.5	1.0	24	1.0	24
23	.....	.....	1.3	47.5	1.0	24	1.0	24
24	.....	.....	1.3	47.5	1.0	24	1.0	24
25	.....	.....	1.3	47.5	1.0	24	1.0	24
26	.....	.....	1.3	47.5	1.1	31.5	1.0	24
27	.....	.....	1.3	47.5	1.0	24	1.0	24
28	.....	.....	1.3	47.5	1.0	24	1.0	24
29	1.5	64	1.3	47.5	1.1	31.5	1.0	24
30	1.5	64	1.3	47.5	1.1	31.5	1.0	24
31	1.5	64	1.3	47.5	.....	.....	1.0	24

Monthly Discharge of Trout Creek at Labute's Ranche, for 1908.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
July (29–31)	64	64	64.00	.....	.....	381
August	64	47.5	49.63	.....	.....	3,052
September	31.5	24	30.00	.....	.....	1,785
October	31.5	24	27.39	.....	.....	1,684
The period	.....	.....	.....	.....	.....	6,902

Trout Creek, near Stevenson's Farm.

As no observer was available for the gauge on Section 33, Township 11, Range 28 west of the 4th Meridian, at Labute's ranche, for 1909, it was necessary to establish a new station elsewhere. A suitable location could not be found above the intakes of Charles Sharples and Messrs. John and William Stevenson's ditches. It was therefore decided to establish another station below these ditches. So far as can be learned no water was diverted by either of the ditches during 1909.

On May 14, 1909, H. C. Ritchie established a station about seven miles south west of Claresholm, at the bridge on the road allowance east of Section 1, Township 12, Range 28 west of the 4th Meridian.

The gauge which is a plain staff, graduated to feet and hundredths, is attached vertically to the left abutment, in line with the downstream side of the bridge. It is referred to the top of the outer pile on the downstream end of the same abutment; elevation 7.99 above the zero of the gauge.

The channel of this stream is very crooked. It is straight for about 60 feet above and 50 feet below the bridge. The banks are low, composed of sand and gravel and partly covered with brush. The stream overflows its banks above the bridge in flood stage, but the water is all carried off through the opening of the bridge.

During higher stages of the stream, discharge measurements are made from the downstream side of the bridge. The initial point for sounding is the inside face of the left abutment. During low water, discharge measurements can be made by wading at or near the bridge.

The gauge was read by John Stevenson.

Discharge Measurements of Trout Creek, near Stevenson's Farm, in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per-sec.*	*Feet.*	*Sec.-ft.*
July 10	H. R. Carscallen	33.5	65.3	3.16	.....	206
1909.						
May 14	H. C. Ritchie	28.3	33.1	1.24	1.40	41.2
June 5	....do	28.3	64.2	2.93	2.50	188
July 2	....do	28.3	40.7	1.56	1.66	63.5
July 28	J. C. Keith	28.3	42.7	1.88	1.79	80.3
August 28	....do	28	24.0	0.70	1.00	16.8
September 15	....do	28	20.4	0.49	0.90	10.1

DAILY Gauge Height and Discharge of Trout Creek, near Stevenson's Farm, for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.10	122.0	1.80	81.0	.....	.....	1.00	15.0	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	.....	.....	2.60	206.0	1.80	81.0	.....	.....	1.00	15.0	.....	.....
4	.....	.....	.....	.....	.....	.....	1.50	49.5	1.00	15.0	1.00	15.0
5	.....	.....	2.50	188.0	.....	.....	.....	.....	.....	.....	1.00	15.0
6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.00	15.0
7	.....	.....	.....	.....	.....	.....	1.40	41.0	1.00	15.0	1.00	15.0
8	.....	.....	2.50	188.0	.....	.....	.....	.....	1.00	15.0	1.00	15.0
9	.....	.....	.....	.....	1.70	69.5	1.30	33.0	.....	.....	.....	.....
10	.....	.....	2.30	153.0	1.70	69.5	.....	.....	1.00	15.0	.....	.....
11	.....	.....	.....	.....	.....	.....	.....	.....	1.00	15.0	.....	.....
12	.....	.....	2.20	138.0	.....	.....	1.30	33.0	.....	.....	1.00	15.0
13	.....	.....	.....	.....	1.60	59.0	.....	.....	1.00	15.0	.....	.....
14	1.40	41.0	.....	.....	.....	.....	1.20	26.5	1.00	15.0	.....	.....
15	1.40	41.0	.....	.....	1.60	59.0	.....	.....	.....	.....	1.00	15.0
16	.....	.....	2.10	122.0	.....	.....	1.20	26.5	1.00	15.0	1.00	15.0
17	.....	.....	.....	.....	1.50	49.5	.....	.....	.....	.....	.....	.....
18	.....	.....	.....	.....	.....	.....	1.20	26.5	1.00	15.0	1.00	15.0
19	.....	.....	2.10	122.0	.....	.....	1.20	26.5	.....	.....	.....	.....
20	1.70	69.5	.....	.....	1.50	49.5	.....	.....	.....	.....	1.00	15.0
21	.....	.....	.....	.....	1.50	49.5	1.20	26.5	1.00	15.0	.....	.....
22	2.50	188.0	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	2.00	108.0	1.50	49.5	.....	.....	1.00	15.0	1.00	15.0
24	3.10	310.0	.....	.....	.....	.....	1.10	20.0	1.00	15.0	.....	.....
25	.....	.....	.....	.....	.....	.....	.....	.....	1.00	15.0	.....	.....
26	3.60	437.0	1.80	81.0	.....	.....	.....	.....	.....	.....	1.00	15.0
27	.....	.....	.....	.....	.....	.....	1.10	20.0	.....	.....	.....	.....
28	.....	.....	.....	.....	1.80	81.0	1.10	20.0	1.00	15.0	1.00	15.0
29	3.00	288.0	1.80	81.0	.....	.....	.....	.....	1.00	15.0	.....	.....
30	.....	.....	.....	.....	1.60	59.0	.....	.....	1.00	15.0	1.00	15.0
31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

MONTHLY Discharge of Trout Creek, Near Stevenson's Farm, for 1909.

[Drainage area 168 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage. area.	Total. in acre-feet.
May (14-31)	437.	41.0	196.4	1.169	0.782	7,013
June	206.	81.0	137.4	0.818	0.913	8.176
July	81.	49.5	63.1	0.375	0.432	3,879
August	49.5	20.	29.1	0.173	0.199	1,788
September	15.	15.	15.	0.089	0.099	893
October	15.	15.	15.	0.089	0.103	922
The period	.....	.....	.....	.....	.....	22,67

Muddypound Creek, at Hart's Ranche.

This station was established by H. C. Ritchie, on July 27, 1908. It is located on L. O. Hart's ranche, eleven miles from Claresholm, on Sec 27, Tp. 11, Rge. 28, W. 4 M.

The gauge, which is a plain staff graduated to feet and hundredths is braced to the left bank, about 15 feet upstream from a foot bridge. It is referred to an iron bolt being driven into the ground, near a fence post about 35 feet N.W. of gauge; elevation 8.94.

The stream which has an average velocity at ordinary stages, flows through a deep and narrow channel. It is straight for 30 feet above and 110 feet below the foot bridge from which the discharge measurements are made. The bed is of clean gravel with soft clay edges. Both banks are high but liable to overflow in excessive floods.

The discharge measurements taken from the foot bridge are quite satisfactory for medium and high stages of the stream, but at very low water the velocity is insufficient for accurate results.

The gauge was read daily by Mr. W. O. Hart whose house is located about 175 yards from the gauge.

Discharge Measurements of Muddypound Creek at Hart's Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 9	H. R. Carscallen	17.5	22	1.72	.....	38.1
July 27	H. C. Ritchie	13.0	21.6	1.07	2.65	23.3
August 5	....do	13.0	20	0.89	2.55	17.8
August 25	H. R. Carscallen	13.0	18.3	0.59	2.40	10.8
September 11	....do	13.0	16.4	0.37	2.27	6.08
September 22	....do	8.5	4.8	1.16	2.25	5.54
1909.						
May 14	H. C. Ritchie	13.6	16.3	0.80	2.34	13.0
June 5	....do	14.0	26.8	1.48	3.02	39.8
July 2	....do	13.5	17.9	0.74	2.45	13.2
July 28	J. C. Keith	13.3	21.5	1.27	2.69	27.3
August 28	....do	13.0	14.9	0.46	2.20	6.87
September 15	....do	13.0	12.6	0.27	2.15	3.38
October 21	A. W. Pae	12.9	11.5	0.31	2.16	3.54

DAILY Gauge Height and Discharge of Muddypound Creek, at Hart's Ranche, for 1908.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.65	23.3	2.37	9.6	2.33	8.1
2	.....	.....	2.64	22.6	2.37	9.6	2.30	7.0
3	.....	.....	2.64	22.6	2.36	9.2	2.30	7.0
4	.....	.....	2.60	20.3	2.35	8.9	2.30	7.0
5	.....	.....	2.55	17.6	2.33	8.1	2.29	6.7
6	.....	.....	2.55	17.6	2.31	7.4	2.28	6.4
7	.....	.....	2.55	17.6	2.31	7.4	2.26	5.9
8	.....	.....	2.54	17.1	2.30	7.0	2.24	5.3
9	.....	.....	2.53	16.6	2.30	7.0	2.23	5.1
10	.....	.....	2.53	16.6	2.30	7.0	2.23	5.1
11	.....	.....	2.53	16.6	2.28	6.4	2.23	5.1
12	.....	.....	2.56	18.1	2.27	6.2	2.23	5.1
13	.....	.....	2.55	17.6	2.26	5.9	2.23	5.1
14	.....	.....	2.54	17.1	2.25	5.6	2.23	5.1
15	.....	.....	2.52	16.0	2.25	5.6	2.30	7.0
16	.....	.....	2.48	14.1	2.26	5.9	2.31	7.4
17	.....	.....	2.48	14.1	2.27	6.2	2.30	7.0
18	.....	.....	2.45	12.9	2.27	6.2	2.29	6.7
19	.....	.....	2.43	12.0	2.27	6.2	2.29	6.7
20	.....	.....	2.41	11.2	2.28	6.4	2.30	7.0
21	.....	.....	2.40	10.7	2.28	6.4	2.29	6.7
22	.....	.....	2.40	10.7	2.28	6.4	2.28	6.5
23	.....	.....	2.40	10.7	2.29	6.7	2.28	6.5
24	.....	.....	2.40	10.7	2.30	7.0	2.28	6.5
25	.....	.....	2.39	10.4	2.33	8.1	2.29	6.7
26	.....	.....	2.38	10.0	2.50	15.0	2.28	6.4
27	2.65	23.3	2.37	9.6	2.70	26.0	2.28	6.4
28	2.66	23.7	2.37	9.6	2.40	10.7	2.27	6.2
29	2.66	23.7	2.37	9.6	2.38	10.0	2.27	6.2
30	2.65	23.3	2.37	9.6	2.35	8.9	2.27	6.2
31	2.65	23.3	2.37	9.6	.....	.....	2.27	6.2

DAILY Gauge Height and Discharge of Muddypound Creek, at Hart's Ranche, for 1909.

Day.	April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.3	11	3.1	43.5
2	.....	.....	2.35	13	3.0	39
3	.....	.....	2.39	14.6	3.0	39
4	.....	.....	2.75	29	3.0	39
5	.....	.....	2.5	19	3.0	39
6	.....	.....	2.3	11	3.0	39
7	.....	.....	2.3	11	2.9	35
8	.....	.....	2.3	11	2.9	35
9	.....	.....	2.3	11	2.9	35
10	.....	.....	2.3	11	2.85	33
11	.....	.....	2.5	19	2.8	31
12	.....	.....	2.45	17	2.8	31
13	.....	.....	2.55	21	2.7	27
14	.....	.....	2.3	11	2.7	27
15	.....	.....	2.43	16.2	2.7	27
16	.....	.....	2.6	23	2.7	27
17	2.3	11	2.45	17	2.7	27
18	2.2	7	2.6	23	2.7	27
19	2.2	7	2.7	27	2.7	27
20	2.3	11	2.9	35	2.7	27
21	2.25	9	3.3	54	2.65	25
22	2.2	7	3.6	73	2.65	25
23	2.2	7	3.7	79.5	2.65	25
24	2.2	7	4.0	101.5	2.65	25
25	3.1	43.5	3.8	86.5	2.65	25
26	3.55	69.7	3.6	73	2.65	25
27	3.2	48.5	3.5	66.5	2.63	24.2
28	2.5	19	3.45	63.2	2.6	23
29	2.3	11	3.3	54	2.55	21
30	2.3	11	3.3	54	2.5	19
31	.....	.....	3.2	48.5	.....	.....

DAILY Gauge Height and Discharge of Muddypound Creek, at Hart's Ranche, for 1909—*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.5	19	2.45	17	2.15	5.7	2.05	3.7
2	2.5	19	2.4	15	2.15	5.7	2.05	3.7
3	2.5	19	2.4	15	2.15	5.7	2.05	3.7
4	2.5	19	2.4	15	2.1	4.5	2.05	3.7
5	2.7	27	2.4	15	2.1	4.5	2.05	3.7
6	2.6	23	2.35	13	2.1	4.5	2.05	3.7
7	2.6	23	2.35	13	2.1	4.5	2.05	3.7
8	2.5	19	2.35	13	2.1	4.5	2.05	3.7
9	2.5	19	2.35	13	2.1	4.5	2.05	3.7
10	2.5	19	2.35	13	2.05	3.7	2.05	3.7
11	2.5	19	2.3	11	2.05	3.7	2.05	3.7
12	2.45	17	2.3	11	2.05	3.7	2.05	3.7
13	2.45	17	2.3	11	2.05	3.7	2.05	3.7
14	2.45	17	2.3	11	2.05	3.7	2.05	3.7
15	2.45	17	2.25	9	2.05	3.7	2.05	3.7
16	2.4	15	2.23	8.2	2.05	3.7	2.05	3.7
17	2.4	15	2.2	7	2.05	3.7	2.05	3.7
18	2.4	15	2.2	7	2.05	3.7	2.05	3.7
19	2.4	15	2.2	7	2.05	3.7	2.05	3.7
20	2.4	15	2.1	4.5	2.05	3.7	2.05	3.7
21	2.4	15	2.1	4.5	2.05	3.7	2.05	3.7
22	2.35	13	2.2	7	2.05	3.7	2.05	3.7
23	2.35	13	2.2	7	2.05	3.7	2.05	3.7
24	2.35	13	2.2	7	2.05	3.7	2.05	3.7
25	2.35	13	2.2	7	2.05	3.7	2.05	3.7
26	2.35	13	2.2	7	2.05	3.7	2.05	3.7
27	3.05	41.2	2.2	7	2.05	3.7	2.05	3.7
28	2.7	27	2.2	7	2.05	3.7	2.05	3.7
29	2.5	19	2.2	7	2.05	3.7	2.05	3.7
30	2.5	19	2.15	5.7	2.05	3.7	2.05	3.7
31	2.5	19	2.15	5.7	.....	.....	2.05	3.7

MONTHLY Discharge of Muddypound Creek at Hart's Ranche, for 1908-9.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
July (27-31)	23.7	23.3	23.46	0.545	0.101	233
August	23.3	9.6	14.61	0.339	0.391	898
September	26.0	5.6	8.23	0.191	0.213	490
October	8.1	5.1	6.33	0.147	0.169	389
The period	.....	.....	.....	.....	.....	2,010
1909.						
April (17-30)	69.7	7.0	19.193	0.446	0.232	533
May	101.5	11.0	35.629	0.828	0.955	2,191
June	43.5	19.0	29.723	0.691	0.771	1,769
July	41.2	13.0	18.490	0.430	0.496	1,137
August	17.0	4.5	9.700	0.225	0.259	596
September	5.7	3.7	4.060	0.094	0.105	242
October	3.7	3.7	3.700	0.086	0.099	227
The period	.....	.....	.....	.....	.....	6,695

WILLOW CREEK, NEAR MACLEOD, ALTA.

A gauging station was established on S.W. ¼ of sec. 25, township 9, range 26 west of the 4th Meridian, by H. C. Ritchie on July 1, 1909.

The gauge which is a plain staff, graduated to feet and hundredths, is located about 300 yards up stream from traffic bridge, near Mr. McLean's stable. It is referenced by a bench mark placed on a post within 50 feet of gauge; elevation 8.41.

The stream flows through a straight channel for about 600 feet below and above the bridge. The slope is uniform and the current is fairly swift. The bed of the channel is of gravel and free from vegetation. The right bank is high and sandy. The left bank is low, wooded, and liable to overflow in flood stages.

The discharge measurements are taken from the downstream side of the bridge at high water. The initial point for soundings is marked zero on the floor of the bridge, at a point in line with the river side of the abutment, under the north end of the bridge. During low water, the stream is waded at the same section.

The gauge was read daily by Jas. R. McLean.

DISCHARGE Measurements of Willow Creek near Macleod in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 1	H. C. Ritchie	98	165	1.84	2.70	303
July 17	do	97.5	132	1.56	2.45	206
August 9	do	74	109	1.30	2.30	141
August 23	do	58	82.7	0.83	1.85	68.9
September 9	do	52.5	74	0.63	1.66	46.6
September 25	do	53	74	0.69	1.71	51.5
October 23	A. W. Pae	51.5	73	0.56	1.66	40.9

Daily Gauge Heights and Discharge of Willow Creek, near Mcleod, Alta., for 1909.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-fi.*	*Feet.*	*Sec.-ft.*
1	2.70	303	2.80	350	1.80	60	1.60	34
2	2.60	262	2.70	303	1.80	60	1.60	34
3	2.50	224	2.60	262	1.80	60	1.60	34
4	2.50	224	2.50	224	1.80	60	1.60	34
5	2.40	190	2.50	224	1.80	60	1.60	34
6	3.10	518	2.40	190	1.80	60	1.60	34
7	3.70	946	2.40	190	1.70	46	1.60	34
8	3.20	584	2.30	161	1.70	46	1.60	34
9	2.90	402	2.20	136	1.70	46	1.60	34
10	2.70	303	2.30	161	1.70	46	1.60	34
11	2.70	303	2.30	161	1.70	46	1.60	34
12	2.70	303	2.30	161	1.70	46	1.60	34
13	2.60	262	2.20	136	1.60	34	1.70	46
14	2.50	224	2.20	136	1.60	34	1.70	46
15	2.50	224	2.10	114	1.60	34	1.70	46
16	2.40	190	2.10	114	1.60	34	1.70	46
17	2.30	161	2.00	94	1.60	34	1.70	46
18	2.30	161	2.00	94	1.60	34	1.70	46
19	2.30	161	2.00	94	1.60	34	1.70	46
20	2.30	161	2.00	94	1.60	34	1.70	46
21	2.30	161	1.90	76	1.70	46	1.70	46
22	2.20	136	1.90	76	1.70	46	1.70	46
23	2.20	136	1.90	76	1.70	46	1.70	46
24	2.20	136	1.90	76	1.70	46	1.70	46
25	2.10	114	1.90	76	1.70	46	1.70	46
26	2.10	114	1.80	60	1.70	46	1.70	46
27	2.00	94	1.80	60	1.70	46	1.70	46
28	3.00	458	1.80	60	1.60	34	1.70	46
29	3.30	652	1.80	60	1.60	34	1.70	46
30	3.20	584	1.80	60	1.60	34	1.70	46
31	3.00	458	1.80	60	.....	.....	1.70	46

Monthly Discharge of Willow Creek, near Mcleod, Alta., for 1909.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
July	946	94	295.1		.....	18,147
August	350	60	133.5	.....	.....	8,209
September	60	34	44.4	.....	.....	2,642
October	46	34	41.4	.....	.....	2,543
The period	.....	.....	.....	.....	.....	31,541

Oldman River, near Cowley, Alta.

This gauging station was established by H. C. Ritchie, on September 15, 1908. It is located at a ford on N.W. ¼ section 34, township 7, range 1 west of the 5th Meridian, approximately four miles from Cowley.

The gauge is a plain staff, graduated to feet and hundredths. It is securely fastened to a tree on the right bank of the river and connected with the channel by a ditch. The gauge is referenced by two bench marks, (1) on a tree within 20 feet; elevation 9.63, (2) a stone within 15 feet; elevation 3.32. During the mid-summer months the gauge reader, Mr. Hugh Pettit, moves upstream about one mile. In order that the reading should not be interrupted, a new rod was placed on the right of the river, within 50 yards of the upstream house. On the periodic trips of the hydrographer, both rods were read and rating curves plotted for each section.

The discharge measurements were taken at the lower rod, where a cable has been erected for high water stages. During low water the river is waded at the same section.

The channel is straight for 900 feet above and 250 feet below the cable. The bed is rocky and free from vegetation. The current has considerable velocity but flows smoothly until below the section, when it breaks into a small rapids. Both banks are high and wooded neither being liable to overflow.

Discharge Measurements of Oldman River, near Cowley, Alta., in 1907–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
September 6	I. J. Walmsley	185	247	3.10	2.55	766
1908.						
August 13	H. R. Carscallen	177.5	175	2.27	1.835	397
August 19	do	161.0	150	2.02	1.695	303
September 15	H. C. Ritchie	115.0	105	1.62	1.50	170
1909.						
May 24	H. C. Ritchie	193	458	5.69	3.18	2,607
June 12	do	196.5	547	6.02	3.60	3,294
July 14	do	190	296	3.74	2.40	1,110
July 30	do	194	414	5.13	3.05	2,125
August 4	do	188	281	3.84	2.35	1,078
August 20	do	183	179	2.27	1.79	406
September 2	do	157	146	1.99	1.61	290
September 21	do	149	131	1.76	1.50	230
October 7	A. W. Pae	136	117	1.63	1.45	190
November 9	do	132	113	1.72	1.46	195

DAILY Gauge Height and Discharge of Oldman River, near Cowley, Alta., for 1908.

Day.	April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.10	.....	7.50	.....
2	.....	.....	2.20	.....	7.40	.....
3	.....	.....	2.40	.....	7.00	.....
4	.....	.....	2.50	.....	6.90	.....
5	.....	.....	2.60	.....	6.40	.....
6	.....	.....	3.00	.....	6.00	.....
7	.....	.....	3.70	.....	5.40	.....
8	.....	.....	3.30	.....	5.10	.....
9	.....	.....	3.10	.....	4.90	.....
10	.....	.....	3.80	.....	4.60	.....
11	.....	.....	4.10	.....	4.50	.....
12	.....	.....	4.20	.....	4.30	.....
13	.....	.....	4.30	.....	4.10	.....
14	.....	.....	4.40	.....	4.00	.....
15	.....	.....	4.70	.....	3.90	.....
16	2.00	.....	4.60	.....	3.80	.....
17	2.10	.....	4.50	.....	3.50	2,990
18	2.20	.....	4.00	.....	3.50	2,990
19	2.30	.....	4.00	.....	3.40	2,780
20	2.50	.....	3.70	.....	3.30	2,580
21	2.70	.....	3.60	.....	3.20	2,390
22	2.30	.....	3.70	.....	3.20	2,390
23	2.40	.....	3.50	.....	3.10	2,200
24	2.30	.....	3.60	.....	3.00	2,015
25	2.30	.....	3.70	.....	2.90	1,835
26	2.20	.....	3.70	.....	2.90	1,835
27	2.10	.....	3.80	.....	2.80	1,665
28	2.20	.....	3.80	.....	2.80	1,665
29	2.30	.....	4.00	.....	2.70	1,500
30	2.20	.....	4.50	.....	2.70	1,500
31	.....	.....	6.60	.....	.....	.....

DAILY Gauge Height and Discharge of Oldman River, near Cowley, Alta., for 1908.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.70	1,500	1.90	460	1.60	225	1.50	170
2	2.70	1,500	1,90	460	1.60	225	1.50	170
3	2.60	1,345	1.80	370	1.60	225	1.50	170
4	2.60	1,345	1.80	370	1.60	225	1.50	170
5	2.60	1,345	1.80	370	1.50	170	1.50	170
6	2.60	1,345	1.80	370	1.50	170	1.50	170
7	2.60	1,345	1.80	370	1.50	170	1.50	170
8	2.50	1,200	1.80	370	1.50	170	1.50	170
9	2.50	1,200	1.80	370	1.50	170	1.50	170
10	2.50	1,200	1.80	370	1.50	170	1.50	170
11	2.40	1,060	1.80	370	1.50	170	1.50	170
12	2.40	1,060	1.80	370	1.50	170	1.50	170
13	2.40	1,060	1.80	370	1.50	170	1.50	170
14	2.40	1,060	1.80	370	1.50	170	1.50	170
15	2.40	1,060	1.70	290	1.50	170	1.50	170
16	2.30	920	1.70	290	1.50	170	1.50	170
17	2.30	920	1.70	290	1.50	170	1.50	170
18	2.30	920	1.70	290	1.50	170	1.50	170
19	2.30	920	1.70	290	1.50	170	1.50	170
20	2.20	790	1.70	290	1.50	170	1.50	170
21	2.20	790	1.70	290	1.50	170	1.50	170
22	2.10	670	1.60	225	1.50	170	1.50	170
23	2.10	670	1.60	225	1.50	170	1.50	170
24	2.10	670	1.60	225	1.50	170	1.50	170
25	2.10	670	1.60	225	1.50	170	1.50	170
26	2.00	560	1.60	225	1.60	225	1.60	225
27	2.00	560	1.60	225	1.60	225	1.60	225
28	2.00	560	1.60	225	1.60	225	1.60	225
29	1.90	460	1.60	225	1.60	225	1.60	225
30	1.90	460	1.60	225	1.60	225	1.60	225
31	1.90	460	1.60	225	.....	.....	1.60	225

NOTE.—During high water in early part of June, conditions at the gauging changed, so that the rating table could not be applied previous to June 17th.

DAILY Gauge Height and Discharge of Oldman River, near Cowley, Alta., for 1907.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.....	1.90	505	4.60	5,720	2.75	1,525	2.85	1,680	1.60	310	1.40	200
2.....	2.00	615	5.50	8,285	2.85	1,680	2.75	1,525	1.60	310	1.40	200
3.....	2.00	615	5.00	6,835	2.85	1,680	2.65	1,380	1.60	310	1.40	200
4.....	1.90	505	4.20	4,690	2.95	1,845	2.55	1,242	1.60	310	1.40	200
5.....	1.90	505	4.10	4,445	3.05	2,020	2.45	1,110	1.60	310	1.40	175
6.....	1.80	410	3.70	3,505	2.95	1,845	2.35	985	1.60	310	1.40	175
7.....	1.80	410	3.50	3,080	3.05	2,020	2.25	870	1.60	310	1.40	175
8.....	1.80	410	3.40	2,875	2.95	1,845	2.25	870	1.50	250	1.40	175
9.....	1.70	330	3.10	2,290	2.85	1,680	2.15	762	1.50	250	1.40	175
10.....	1.70	330	3.20	2,480	2.85	1,680	2.15	762	1.50	250	1.40	175
11.....	1.60	265	3.60	3,290	2.75	1,525	2.05	662	1.50	250	1.40	175
12.....	1.70	330	3.60	3,290	2.75	1,525	2.05	662	1.50	250	1.40	175
13.....	1.70	330	3.75	3,545	2.75	1,525	2.05	662	1.50	250	1.40	175
14.....	1.80	410	3.85	3,795	2.65	1,380	1.95	572	1.50	250	1.40	175
15.....	1.80	410	3.95	4,050	2.55	1,242	1.95	572	1.50	250	1.40	175
16.....	1.80	410	4.05	4,310	2.55	1,242	1.95	572	1.50	250	1.40	175
17.....	1.70	330	4.05	4,310	2.45	1,110	1.95	572	1.50	250	1.40	175
18.....	1.70	330	3.85	3,795	2.35	985	1.85	490	1.50	250	1.40	175
19.....	1.60	265	3.75	3,545	2.25	870	1.85	490	1.50	250	1.40	175
20.....	2.00	615	3.65	3,300	2.25	870	1.85	490	1.50	250	1.40	175
21.....	2.20	850	3.45	2,827	2.25	870	1.80	450	1.50	250	1.40	175
22.....	2.40	1,110	3.35	2,607	2.15	762	1.80	450	1.50	250	1.40	175
23.....	2.60	1,420	3.25	2,400	2.15	762	1.70	375	1.50	250	1.40	175
24.....	3.20	2,480	3.15	2,205	2.05	662	1.70	375	1.40	200	1.40	175
25.....	3.60	3,290	3,05	2,020	.....	.....	1.70	375	1.40	200	1.40	175
26.....	3.90	3,965	2.95	1,845	.....	.....	1.70	375	1.40	200	1.40	175
27.....	4.00	4,205	2.85	1,680	.....	.....	1.70	375	1.40	200	1.40	175
28.....	4.20	4,690	2.75	1,525	.....	.....	1.70	375	1.40	200	1.40	175
29.....	4.20	4,690	2.75	1,525	.....	.....	1.70	375	1.40	200	1.40	175
30.....	4.20	4,690	2.75	1,525	.....	.....	1.70	375	1.40	200	1.40	175
31.....	4.20	4,690	.....	.....	.....	.....	1.60	310	.....	.....	1.40	175

NOTE.—From June 13th to October 5th, the observer read the upper gauge. During the remainder of the season he read the lower gauge.

MONTHLY Discharge of Oldman River, near Cowley, Alta., for 1908–9.

[Drainage area, 798 square miles.]

	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
June (17-30)	2,990	1,500	2,166.8	2.715	1.413	60,168
July	1,500	460	955.6	1.197	1.380	58,760
August	460	225	311.0	0.389	0.448	19,121
September	225	170	186.5	0.233	0.260	11,097
October	225	170	180.6	0.226	0.261	11,107
The period	.....	.....	.....	.....	.....	160,253
1909.						
May	4,690	265	1,432.6	1.795	2.069	88,087
June	8,285	1,525	3,386.5	4.244	4.735	201,508
July (1-24)	2.020	662	1,381.2	1.731	1.543	65,752
August	1,680	310	681.9	0.855	0.986	41,931
September	310	200	252.3	0.316	0.353	15,015
October	200	175	178.2	0.223	0.257	10,958
The period	.....	.....	.....	.....	.....	423,251

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements of Oldman River, at the traffic bridge on Sec. 26, Tp. 7, Range 30, west of the 4th Meridian, near Pincher, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Sec.-ft.*
July 15	H. C. Ritchie	287	829	2,672
1909.				
July 15	H. C. Ritchie	287.5	771	2,830
August 6	....do	287.5	753	2,672

CROWSNEST RIVER, NEAR LUNDBRECK, ALTA.

A gauge station was established on the Crowsnest River by P. M. Sauder, on September 7th, 1907. It is located at the traffic bridge, north of Lundbreck on Section 26, Tp. 7, Range 2, west of the 5th Meridian.

The gauge is a plain staff, graduated to feet and hundreds. It is placed down stream from the bridge, about 20 yards and securely fastened to a post, several feet in from the water's edge. It is connected to the channel by a ditch which is kept open by the hydrographer on his periodic trips. The gauge is referenced by a bench mark, located on a tree about 30 yards back from the left bank; elevation 9.74.

The channel is straight for 250 feet above the bridge and 1,500 feet below. The current is very swift and owing to the rocky bottom, considerable amount of rough water is encountered. The right bank is high and wooded in a few places. The left bank is low and wooded and liable to overflow in excessive flood stage. The river flows in one channel over a bed of rock, free from vegetation.

The discharge measurements are taken from the bridge. The initial point for soundings is marked zero on the lower cord of the downstream side of the bridge. Intermediate points are marked every five feet.

The gauge was read once each day by J. G. Short, and a series of discharge measurements were made during 1908 and 1909, but a satisfactory rating table has not yet been obtained. None of the results are published with this report, but it is expected that by the end of 1910, a satisfactory rating table will be established and will if possible be applied to the records for 1908 and 1909 as well as those of 1910.

Todd Creek near Cowley, Alta.

A gauging station was established on this creek, on August 3rd, 1909, by H. C. Ritchie. It is situated within 20 feet of Mr. Cecil Elton's house on Section 19, Tp. 8, Range 1, west of the 5th Meridian.

The gauge consists of a plain staff, graduated to feet and hundredths, driven into the bed of the stream and securely braced to the left bank. The gauge is referenced by a bench mark about ten feet from it, on the left bank. The bench mark is established on a stake driven into the ground; elevation 6.70 above the zero of the gauge.

The channel is straight for about 55 feet above and 60 feet below the gauge. The water is inclined to be swift at high stages but quite sluggish at low. The bed lies in one channel and is composed of clean sand and gravel. The right bank is high and wooded and liable to overflow in excessive flood. The left bank is wooded and liable to overflow for about 5 feet from edge, when it rises abruptly to about six feet.

During high stages the discharge measurements are taken from a private traffic bridge, situated about 200 yards below the gauge and during low water, measurements are taken at a wading section, at the gauge. The initial point is marked on a tree situated on the left bank.

The gauge is read daily by Mr. Cecil Elton.

Discharge Measurements of Todd Creek near Cowley, Alta., 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 20	H. R. Carscallen	19.3	13.4	0.76	.....	10.1
1909.						
June 14	H. C. Ritchie	23.5	35	2.23	.....	77.9
July 14	....do	16.3	18.2	1.32	.....	24.0
August 3	....do	20.8	35	0.98	3.20	34.4
August 19	....do	20.1	28.3	0.50	2.89	14.2
September 6	....do	20.9	26.6	0.35	2.79	9.32
September 21	....do	20.0	25.6	0.30	2.74	7.64
November 9	A. W. Pae	20.4	23.2	0.29	2.70	6.68

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Crowsnest Mountain from Coleman, Alta.

DAILY Gauge Height and Discharge of Todd Creek, near Cowley, Alta., for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	3.20	34.40	2.80	9.75	2.70	6.68
2	3.20	34.40	2.80	9.75	2.70	6.68
3	3.20	34.40	2.825	10.90	2.70	6.68
4	3.20	34.40	2.80	9.75	2.70	6.68
5	3.15	30.70	2.795	9.60	2.70	6.68
6	3.10	27.00	2.785	9.29	2.70	6.68
7	3.10	27.00	2.78	9.14	2.70	6.68
8	3.10	27.00	2.745	8.06	2.69	6.30
9	3.10	27.00	2.73	7.60	2.69	6.30
10	3.10	27.00	2.70	6.68	2.71	6.99
11	3.00	20.20	2.715	7.14	2.71	6.99
12	3.00	20.20	2.72	7.29	2.70	6.68
13	3.00	20.20	2.75	8.21	2.70	6.68
14	3.00	20.20	2.725	7.45	2.70	6.68
15	2.95	17.40	2.70	6.68	2.70	6.68
16	2.90	15.00	2.70	6.68	2.70	6.68
17	2.90	15.00	2.71	6.99	2.71	6.99
18	2.90	15.00	2.725	7.45	2.71	6.99
19	2.90	15.00	2.71	6.99	2.71	6.99
20	2.90	15.00	2.70	6.68	2.71	6.99
21	2.90	15.00	2.715	7.14	2.70	6.68
22	2.90	15.00	2.725	7.45	2.70	6.68
23	2.90	15.00	2.715	7.14	2.70	6.68
24	2.90	15.00	2.705	6.83	2.70	6.68
25	2.85	12.10	2.70	6.68	2.70	6.68
26	2.85	12.10	2.70	6.68	2.70	6.68
27	2.85	12.10	2.70	6.68	2.70	6.68
28	2.85	12.10	2.70	6.68	2.70	6.68
29	2.85	12.10	2.705	6.83	2.71	6.99
30	2.85	12.10	2.71	6.99	2.72	7.29
31	2.80	9.75	.....	.....	2.70	6.68

MONTHLY Discharge of Todd Creek, near Cowley, Alta., for 1909.

[Drainage area, 61 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage. area.	Total. in acre-feet.
August	34.4	9.75	19.8	0.325	0.375	1,219
September	10.9	6.68	7.7	0.126	0.141	459
October	7.29	6.30	6.7	0.110	0.127	414
The period	.....	.....	.....	.....	.....	2,092

COW CREEK, NEAR COWLEY, ALTA.

The gauging station on Cow Creek was established by H. C. Ritchie on August 2nd, 1909. It is situated on the farm of Mr. Abel Brux, Section 12, Tp. 8, Range 2, west of the 5th Meridian.

The gauge consists of a plain staff, graduated to feet and hundredths, driven into the bed of the stream and firmly braced by scantling, fastened to the right bank. The gauge is referenced by two bench marks: (1) a stone on left bank, about 30 feet above gauge, elevation 6.03; (2) a hub driven into the ground on the left bank, about 10 feet below gauge, elevation 9.09.

This stream has a very crooked channel. For about 40 feet above the gauge and 54 feet below, the stream is straight. The bed is composed of gravel and sand, free from vegetation, with a few boulders which cause small rapids above and below the gauge. Both banks are about three feet high, wooded and liable to overflow at flood stages.

The discharge measurements are taken from a foot bridge about 10 feet below the gauge; the initial point being marked zero on the left end of the bridge. During high stages the flow is inclined to be swift but quite sluggish at low water.

The daily gauge height was read by Abel Brux, whose house is within 300 feet of the gauge.

DISCHARGE Measurements of Cow Creek, near Cowley, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1908.						
August 20	H. R. Carscallen	6.5	4.7	0.45	.....	2.12
1909.						
June 14	H. C. Ritchie	11.0	20.7	1.59	.....	32.8
July 14	....do	11.0	15.5	0.61	.....	9.50
August 2	....do	13.0	22	1.04	2.90	23.1
August 19	....do	13.0	18	0.45	2.60	8.15
September 6	....do	13.0	16.5	0.25	2.45	4.20
September 21	....do	13.0	16.0	0.23	2.38	3.78
October 7	A. W. Pae	13.0	14.9	0.17	2.35	2.57
November 9	....do	12.5	13.7	0.26	2.36	3.55

DAILY Gauge Height and Discharge of Cow Creek, near Cowley, Alta., for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.9	23.1	2.6	8.15	2.4	3.30
2	2.9	23.1	2.6	8.15	2.4	3.30
3	2.9	23.1	2.6	8.15	2.4	3.30
4	2.85	20.4	2.6	8.15	2.4	3.30
5	2.85	20.4	2.6	8.15	2.4	3.30
6	2.85	20.4	2.5	5.30	2.4	3.30
7	2.85	20.4	2.5	5.30	2.37	2.86
8	2.85	20.4	2.5	5.30	2.4	3.30
9	2.7	12.4	2.5	5.30	2.4	3.30
10	2.7	12.4	2.5	5.30	2.4	3.30
11	2.7	12.4	2.5	5.30	2.45	4.30
12	2.7	12.4	2.5	5.30	2.45	4.30
13	2.7	12.4	2.4	3.30	2.45	4.30
14	2.7	12.4	2.4	3.30	2.4	3.30
15	2.6	8.15	2.4	3.30	2.4	3.30
16	2.6	8.15	2.4	3.30	2.4	3.30
17	2.6	8.15	2.4	3.30	2.4	3.30
18	2.6	8.15	2.4	3.30	2.45	4.30
19	2.6	8.15	2.4	3.30	2.45	4.30
20	2.6	8.15	2.4	3.30	2.45	4.30
21	2.6	8.15	2.4	3.30	2.4	3.30
22	2.6	8.15	2.4	3.30	2.4	3.30
23	2.6	8.15	2.4	3.30	2.4	3.30
24	2.6	8.15	2.4	3.30	2.4	3.30
25	2.6	8.15	2.4	3.30	2.4	3.30
26	2.6	8.15	2.4	3.30	2.4	3.30
27	2.6	8.15	2.4	3.30	2.4	3.30
28	2.6	8.15	2.4	3.30	2.4	3.30
29	2.6	8.15	2.4	3.30	2.45	4.30
30	2.6	8.15	2.45	4.30	2.45	4.30
31	2.6	8.15	.....	.....	2.4	3.30

MONTHLY Discharge of Cow Creek, near Cowley, Alta., for 1909.

[Drainage area, 36.4 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
August	23.1	8.15	12.39	0.340	0.392	762
September	8.15	3.30	4.61	0.126	0.141	274
October	4.30	3.30	3.54	0.097	0.112	218
The period	.....	.....	.....	.....	.....	1,254

Connely Creek, near Lundbreck, Alta.

A regular gauging station was established on Connely Creek, by H. C. Ritchie on July 31st, 1909. This station is located on the trail which crosses the creek about 100 feet above its mouth.

The gauge which consists of a plain staff, graduated to feet and hundredths, is securely fastened to a tree, on the left bank of the stream. The gauge is referenced by a bench mark, consisting of a spike driven into a post about 15 feet from the gauge; elevation 7.42 above zero of the gauge.

This stream has a very crooked channel; it being very difficult to find a place suitable for gauging. For about 20 feet below and above the gauge, the stream is practically straight, with very little slope. The bed is of gravel and sand, free from vegetation. The right bank is low and liable to overflow at high stages of the stream; the left bank is comparatively high. Both banks are thickly wooded along the edge.

During high stages, discharge measurements are made from a foot bridge near the gauge; the initial point being a stake on the right bank, to which the zero of the tape is fastened. During low stages the velocity at this point is insufficient for accurate results and a wading section is taken about 200 feet upstream.

The daily gauge height was read by N. V. Holway, whose house is within 200 feet of the gauge.

Discharge Measurements of Connely Creek, near Lundbreck, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 20	H. R. Casreallen	2.8	0.9	0.96	.....	0.87
1909.						
June 14	H. C. Ritchie	11.5	9.7	1.30	.....	12.66
July 13	....do	6.9	2.3	1.63	.....	3.69
July 29	....do	12.2	12.8	1.52	2.94	19.5
July 31	....do	12.2	11	0.97	2.79	10.8
August 19	....do	11.5	7.7	0.31	2.60	2.44
September 4	....do	8.2	8.2	0.23	2.55	1.92
September 20	....do	8.4	2	0.49	2.49	.97
October 9	A. W. Pae	7.7	1.9	0.34	2.44	.65
November 10	....do	8.3	4.4	0.30	2.50	1.32

DAILY Gauge Height and Discharge of Connely Creek, near Lundbreck, Alta., for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.7	6.3	2.6	2.45	2.5	1.2
2	2.7	6.3	2.6	2.45	2.5	1.2
3	2.7	6.3	2.6	2.45	2.5	1.2
4	2.7	6.3	2.6	2.45	2.5	1.2
5	2.7	6.3	2.6	2.45	2.45	.85
6	2.7	6.3	2.6	2.45	2.45	.85
7	2.7	6.3	2.6	2.45	2.45	.85
8	2.7	6.3	2.6	2.45	2.45	.85
9	2.7	6.3	2.6	2.45	2.45	.85
10	2.7	6.3	2.6	2.45	2.5	1.2
11	2.7	6.3	2.6	2.45	2.5	1.2
12	2.7	6.3	2.6	2.45	2.5	1.2
13	2.7	6.3	2.6	2.45	2.5	1.2
14	2.7	6.3	2.6	2.45	2.5	1.2
15	2.7	6.3	2.6	2.45	2.5	1.2
16	2.7	6.3	2.6	2.45	2.5	1.2
17	2.7	6.3	2.6	2.45	2.5	1.2
18	2.7	6.3	2.5	1.2	2.5	1.2
19	2.6	2.45	2.5	1.2	2.5	1.2
20	2.6	2.45	2.5	1.2	2.5	1.2
21	2.6	2.45	2.5	1.2	2.5	1.2
22	2.6	2.45	2.5	1.2	2.5	1.2
23	2.6	2.45	2.5	1.2	2.5	1.2
24	2.6	2.45	2.5	1.2	2.5	1.2
25	2.6	2.45	2.5	1.2	2.5	1.2
26	2.6	2.45	2.5	1.2	2.5	1.2
27	2.6	2.45	2.5	1.2	2.5	1.2
28	2.6	2.45	2.5	1.2	2.5	1.2
29	2.6	2.45	2.5	1.2	2.5	1.2
30	2.6	2.45	2.5	1.2	2.5	1.2
31	2.6	2.45	.....	.....	2.5	1.2

MONTHLY Discharge of Connely Creek, near Lundbreck, Alta., for 1909.

[Drainage area, 17 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
August	6.30	2.45	4.685	0.275	0.317	288
September	2.45	1.20	1.908	0.112	0.125	113
October	1.20	0.85	1.143	0.067	0.077	70
The period	.....	.....	.....	.....	.....	471

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Crownest River and its Tributaries, in 1908–9.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1908.				*Sec.-ft.*
Aug. 14	Rock Creek	N.E. 20-7-2-5	H. R Carscallen	4.3
Aug. 15	Gold Creek	At Frank below intake of water-works.	do	29.
Aug. 15	York Creek	Near mouth	do	10.1
Aug. 15	McGillivray Creek	Near mouth	do	3.8
Aug. 17	Nez-perce Creek	At Coleman	do	0.5
Aug. 17	Blairmore Creek	Near mouth	do	5.5
Aug. 17	Lyon Creek	Near mouth	do	0.7
Aug. 18	Byron Creek	Near mouth	do	3.9
1909.				
July 29	Crownest River	At traffic bridge on N.E. 29-7-1-5.	H. C. Ritchie	1958
Sept. 6	do	do	do	240
Oct. 8	do	do	A. W. Pae	166
Oct. 11	Rock Creek	N.E. 20-7-2-5	do	3.1
Oct. 11	Byron Creek	S.W. 16-7-3-5	do	3.8
Oct. 12	Gold Creek	At Frank, below intake of water works.	do	20.3
Oct. 12	do	Near Frank, above intake of water works.	do	24.0
Oct. 13	Lyon Creek	N.E. 26-7-4-5	do	1.2
Oct. 13	do	At mouth	do	Dry.
Oct. 13	Blairmore Creek	Sec. 10-8-4-5	do	3.6
Oct. 14	York Creek	N.W. 34-7-4-5	do	6.1
Oct. 15	Allison Creek	Sec. 11-8-5-5	do	13.
Oct. 15	McGillivray Creek	Sec. 7-8-4-5	do	2.7
Oct. 16	Crownest River	Sec. 7-8-4-5, above mouth of McGillivray Creek.	do	69.
Nov. 10	do	N. E. 29-7-1-5	do	150.
Nov. 11	Gold Creek	At Frank, below intake of water-works.	do	16.
Nov. 12	York Creek	N.W. 34-7-4-5	do	4.9
Nov. 12	Blairmore Creek	Sec. 10-8-4-5	do	1.9
Nov. 12	Lyon Creek	N.E. 26-7-4-5	do	2.5
Nov. 13	Crownest River	Sec. 7-8-4-5, above mouth of McGillivray Creek.	do	45.
Nov. 13	McGillivray Creek	Sec. 7-8-4-5	do	2.8

South Fork River, near Cowley, Alta.

This gauging station was established by H. C. Ritchie on August 5th, 1909. It is located at the traffic bridge, between Pincher Creek and Cowley.

The gauge rod which consists of a plain staff graduated to feet and hundredths was securely fastened to the west side of the second pier from the left bank of the river. It was referred to a bench mark placed on top of abutment at the north west corner of the bridge. On account of the section changing during floods, the gauge was removed to Mr. Buchanan's ranch, about one half mile downstream, S.W. ¼ Sec. 2, Tp. 7, Range 1, west of the 5th Meridian. It is referred in its new position to a bench mark placed on a tree within 20 feet of the gauge; elevation 8.33.

The river above the bridge is separated into two channels by a low rocky island, which is submerged in very high water. These two channels come together about fifty feet above the bridge but is divided again into three by the piers of the bridge, which form gravel bars for some distance down stream. The bed of the river is quite rough and free from vegetation. The current is very swift, except through the east channel, where the water becomes

dead at low stages. The left bank is low and rocky, without vegetation. The right bank is high and rocky but liable to be overflowed below the bridge in high stages.

Discharge measurements are taken from the downstream side of the bridge in both low and high water. The initial point for soundings is marked zero and is in line with abutment on left bank. Owing to rough state of bed, considerable care has to be exercised in determining area of section.

The gauge was read daily by Mr. G. W. Buchanan, who lives within two minutes walk from its present location.

DISCHARGE Measurements of Southfork River, near Cowley, Alta., 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 10	H C. Ritchie	204.7	415	3.20	.....	1,328
July 18	....do	137.3	226	3.81	.....	859
August 12	H. R. Carscallen	142.0	198	2.80	.....	359
August 21	....do	137.5	183	2.48	.....	283
September 17	P. M. Sauder	103.0	89	1.70	.....	152
1909.						
July 12	H. C. Ritchie	202.5	397	4.00	.....	1,589
August 5	....do	203.5	345	2.84	2.50	979
August 18	....do	106.5	229	2.66	1.76	611
September 7	....do	93.0	179	1.73	1.45	310
September 23	....do	89.0	164	1.47	1.33	242
October 6	A. W. Pae	86.5	156	1.35	1.24	211

DAILY Gauge Height and Discharge of South Fork River, near Cowley, Alta., for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.5	350	1.3	230
2	.....	.....	1.5	350	1.3	230
3	.....	.....	1.5	350	1.3	230
4	.....	.....	1.5	350	1.3	230
5	2.5	980	1.5	350	1.2	200
6	2.4	928	1.5	350	1.2	200
7	2.3	876	1.4	278	1.2	200
8	2.3	876	1.4	278	1.2	200
9	2.2	825	1.4	278	1.2	200
10	2.1	775	1.4	278	1.2	200
11	2.1	775	1.4	278	1.2	200
12	2.0	725	1.4	278	1.2	200
13	2.0	725	1.4	278	1.2	200
14	2.0	725	1.4	278	1.2	200
15	1.9	676	1.4	278	1.2	200
16	1.9	676	1.4	278	1.2	200
17	1.8	628	1.4	278	1.2	200
18	1.8	628	1.4	278	1.2	200
19	1.8	628	1.4	278	1.2	200
20	1.7	585	1.3	230	1.2	200
21	1.7	585	1.3	230	1.2	200
22	1.7*	540	1.3	230	1.2	200
23	1.7	540	1.3	230	1.2	200
24	1.6	440	1.3	230	1.2	200
25	1.6	440	1.3	230	1.2	200
26	1.6	440	1.3	230	1.2	200
27	1.6	440	1.3	230	1.2	200
28	1.6	440	1.3	230	1.2	200
29	1.6	440	1.3	230	1.2	200
30	1.5	350	1.3	230	1.2	200
31	1.5	350	.....	.....	1.2	200

*Gauge was moved from traffic bridge to Buchanan's Ranche on August 22nd.

MONTHLY Discharge of South Fork River, near Cowley, Alta., for 1909.

[Drainage area, 385 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
August (5-31)	980	350	631	1.639	1.646	33,790
September	350	230	274.8	0.713	0.795	16,352
October	230	200	203.9	0.529	0.610	12,535
The period	.....	.....	.....	.....	.....	62,677

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Tributaries of South Fork River, in 1909.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
				Sec.-ft.
October 5	Mill Creek	S.E. 13-6-2-5	A. W. Pae	31.6
November 8	....do	....do	....do	25.7
October 5	Canyon Creek	N.W. 24-6-2-5	....do	3.75
November 8	....do	....do	....do	4.13

Pincher Creek at Pincher Creek, Alta..

Under the direction of Mr. Arthur O. Wheeler a regular gauging station was established on this creek at the town of Pincher Creek in the spring of 1898. Again on August the 13th, 1906, Mr. J. F. Hamilton replaced the old gauge by a new one. Owing to local improvements the gauge has since been changed but the station remains practically in the same place as established under the direction of Mr. Wheeler.

The present gauge consists of a plain staff, graduated to tenths and hundredths of feet, securely fastened to the cribbing on the right bank of the river about 20 feet below the traffic bridge. It is referred to bench marks placed on the north abutment and a low pile underneath the bridge at the left bank; elevations, 7.75 and 3.40 feet respectively above zero of the gauge.

During high water, discharge measurements were made from the downstream side of the bridge. At low stages, wading sections are used at the bridge and later in the season at a point about a mile upstream.

At the regular station the channel is straight for about half a mile above and 200 yards below. The bed is very rocky and is free from vegetation. Both banks are high, the right being well cribbed; neither is liable to overflow. At the wading section above, the channel is straight for about 100 feet above and below the section. The stream flows comparatively swift over a hard clay bed. The right bank is low and liable to overflow; the left bank is a high clay cut bank.

Owing to continued local improvements being made on the stream it has been impossible to procure a permanent cross-section. On this account, a discharge table of sufficient accuracy has not been obtained. The gauge was read daily 1908 and 1909 by P. Bertles.

DISCHARGE Measurements of Pincher Creek at Pincher Creek, Alta., in 1906–7–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 13	J. F. Hamilton	24	24.0	0.28	.....	6.7
1907.						
July 6	I. J. Walmsley	50	80.0	2.10	1.50	169
August 16	....do	28	24.2	0.69	0.70	16.8
September 5	....do	30	28.5	1.20	0.80	34
1908.						
July 9	H. C. Ritchie	64.5	116	0.54	1.27	62.2
August 12	H. R. Carscallen	24	35	0.47	0.94	16.5
August 22	....do	26	13.5	0.88	0.88	11.9
September 8	H. C. Ritchie	12	5.9	0.65	0.69	3.82
September 18	P. M. Sauder	15	11.7	0.54	0.90	6.30
1909.						
May 25	H. C. Ritchie	84	190	3.78	3.275	719
June 10	....do	65.6	98	3.62	3.90	355
June 18	....do	64.3	81.6	3.07	3.75	251
July 12	....do	60.5	43.3	1.95	1.81	84.6
July 28	....do	82	174	7.21	3.65	1,258
August 7	....do	34	29	2.10	1.89	60.8
August 18	....do	30.5	17.7	1.56	1.55	27.6
September 1	....do	18.3	8.7	1.56	1.40	13.5
September 18	....do	18.5	8.2	1.41	1.37	11.5
October 6	A. W. Pae	13.3	5.9	1.13	1.28	6.73
October 19	....do	15.2	6.2	1.12	1.31	6.97
November 6	....do	14	7	1.12	1.38	7.88

DAILY Gauge Height, in feet, of Pincher Creek at Pincher Creek, Alta., for 1908.

Day.	April.	May.	June.	July.	August.	Sept.	Oct.
1	0.7	1.0	5.5	1.4	1.0	0.8	0.9
2	0.7	0.9	3.5	1.4	1.0	0.7	1.0
3	1.6	0.9	3.6	1.4	1.0	0.7	1.0
4	1.0	0.9	7.7	1.4	1.0	0.7	1.05
5	0.8	0.8	8.6	1.45	1.0	0.7	1.1
6	0.7	0.9	6.5	1.45	1.0	0.7	1.1
7	0.7	1.0	4.7	1.5	1.0	0.7	1.1
8	0.7	1.1	2.6	1.4	1.0	0.7	1.1
9	0.8	1.1	2.4	1.4	1.0	0.7	1.1
10	1.0	1.1	2.4	1.3	1.0	0.7	1.1
11	1.0	1.6	2.2	1.3	1.0	0.7	1.1
12	1.0	2.7	1.8	1.3	1.0	0.7	0.9
13	1.0	2.5	1.6	1.4	1.0	0.7	0.9
14	0.9	2.8	1.6	1.5	1.0	0.7	1.0
15	0.9	2.3	1.5	1.4	1.0	0.6	1.2
16	0.8	2.5	1.4	1.3	1.0	0.6	1.2
17	0.8	2.0	1.4	1.3	0.9	0.9	1.2
18	1.1	2.0	1.3	1.3	0.9	0.9	1.2
19	1.1	1.8	1.2	1.3	0.9	0.9	1.1
20	1.1	1.7	1.2	1.3	1.0	0.9	1.1
21	1.0	1.7	1.2	1.2	0.9	0.8	1.2
22	1.0	1.6	1.2	1.2	0.8	0.8	1.2
23	1.1	1.6	1.2	1.2	0.8	1.2	1.1
24	1.0	1.5	1.3	1.2	0.8	1.2	1.1
25	1.0	1.6	1.3	1.2	0.8	1.2	0.9
26	1.0	2.5	1.3	1.2	0.8	1.2	0.9
27	1.0	3.6	1.3	1.0	0.8	1.2	0.9
28	1.1	2.6	1.3	1.0	0.8	1.1	0.9
29	1.1	2.6	1.3	1.0	0.8	1.1	1.0
30	1.0	2.7	1.3	1.0	0.8	1.0	1.0
31	.....	3.1	.....	1.0	0.8	.....	1.0

DAILY Gauge Height, in feet, of Pincher Creek, at Pincher Creek, Alta., for 1909.

Day.	April.	May.	June.	July.	August.	Sept.	Oct.
1	1.8	1.2	4.3	3.3	2.3	1.4	1.3
2	1.8	3.5	4.1	3.3	2.1	1.4	1.3
3	1.6	4.0	4.0	3.2	2.0	1.4	1.3
4	1.4	3.3	4.0	3.2	1.9	1.4	1.3
5	1.2	3.5	4.0	4.0	1.8	1.4	1.3
6	1.1	2.6	3.7	4.0	1.6	1.4	1.2
7	1.0	2.4	3.7	4.0	1.4	1.4	1.2
8	1.3	2.2	4.2	3.8	1.4	1.4	1.2
9	1.4	2.2	4.0	3.6	1.4	1.4	1.2
10	1.0	2.0	3.7	3.4	1.5	1.4	1.2
11	1.2	2.0	3.8	3.0	1.7	1.4	1.2
12	1.1	2.2	3.8	1.8	1.6	1.4	1.3
13	1.0	2.0	3.8	1.8	1.6	1.4	1.3
14	1.0	2.3	3.8	1.7	1.6	1.4	1.3
15	1.1	2.4	3.8	1.7	1.6	1.4	1.3
16	1.1	1.9	3.8	1.6	1.6	1.4	1.3
17	1.2	2.0	3.8	1.6	1.6	1.4	1.3
18	1.1	2.3	3.8	1.6	1.6	1.4	1.4
19	1.0	2.1	3.8	1.5	1.5	1.4	1.4
20	1.0	2.3	4.4	1.5	1.5	1.4	1.4
21	1.1	2.4	4.1	1.4	1.5	1.4	1.4
22	1.1	2.6	4.1	1.3	1.5	1.4	1.4
23	1.0	3.7	4.0	1.2	1.5	1.4	1.4
24	1.3	3.3	3.9	1.0	1.4	1.4	1.4
25	2.0	3.7	3.7	1.0	1.4	1.4	1.3
26	1.6	3.6	3.7	1.7	1.4	1.4	1.3
27	1.6	3.4	3.5	4.1	1.4	1.4	1.3
28	1.4	3.0	3.5	2.7	1.4	1.4	1.3
29	1.3	3.0	3.3	2.7	1.4	1.3	1.3
30	1.2	3.1	3.3	2.6	1.4	1.3	1.3
31	.....	4.0	.....	2.4	1.4	.....	1.3

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements of Pincher Creek, at the ford on Sec. 7, Tp. 7, Range 28 west of the 4th Meridian, in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Sec.-ft.*
August... 22	H. R. Carscallen	21	11.06	12.07
1909.				
October 20	A. W. Pae	11.4	12.62	8.42

Waterton River, at Waterton Mills, Alta.

This station was established by P. M. Sauder on August 26th, 1908. It is located about 250 feet downstream, from where the river leaves the lake.

The gauge which is a plain staff, graduated to feet and hundredths, is located in a box cribbing, on the right bank of the river. It is referred to a bench mark, placed on the root of a tree, six feet distant; elevation 9 69 above the zero of the gauge.

The channel, which is very wide, is straight for 300 feet above the section and 100 feet below.

During low water the bulk of the stream flows through a deep and narrow channel in the middle of the river. The bed of the stream is rough and rocky. There is a good flow at all stages, but not swift. Both banks are quite high and wooded and no danger of an overflow.

The discharge measurements are taken from a car suspended from a cable. During low water the stream is waded most of the way across. The deep channel in the middle has to be measured from the car at all stages. The measurements at this station are affected by the wind which blows quite frequently. The cross-section is so constituted, that, when a rating curve has been obtained, it will not be likely to change.

The gauge was read daily by H. H. Hanson whose house is situated about 600 feet from the gauge.

Discharge Measurements of Waterton River, at Waterton Mills, Alta., in 1906–7–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
September 10....	J. F. Hamilton.....	289	220	2.01	.....	442
1907.						
July 20.....	I. J. Walmsley.....	293	619	3.51	4.10	2,177
1908.						
September 5.....	H. C. Ritchie.....	227	159	1.29	2.50	205
September 18....	H. R. Carscallen.....	210.5	172	1.38	2.49	238
1909.						
May 28.....	H. C. Ritchie.....	298	766	4.99	4.70	3,822
June 23.....	....do.....	300	890	5.52	5.10	4,918
July 23.....	....do.....	288	388	2.66	3.39	1,030
August 14.....	....do.....	286	304	2.12	3.09	645
August 28.....	....do.....	230	228	1.64	2.80	373
September 16....	....do.....	228	205	1.52	2.65	312
October 2.....	A. W. Pae.....	215	185	1.35	2.51	251
November 3.....	....do.....	180	160	1.46	2.49	234

DAILY Gauge Height and Discharge of Waterton River, at Waterton Mills, Alta., for 1908.

Day.	April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.6	.....	4.7	.....
2	.....	.....	3.5	.....	4.8	.....
3	.....	.....	3.5	.....	5.1	.....
4	.....	.....	3.5	.....	6.5	.....
5	.....	.....	3.6	.....	8.2	.....
6	.....	.....	3.7	.....	*a*	.....
7	.....	.....	3.9	.....	8.2	.....
8	.....	.....	3.9	.....	7.4	.....
9	.....	.....	4.0	.....	6.3	.....
10	.....	.....	4.0	.....	6.0	7,750
11	.....	.....	4.1	.....	5.8	7,073
12	2.3	.....	4.1	.....	5.6	6,414
13	2.4	.....	4.2	.....	5.4	5,790
14	2.6	.....	4.3	.....	5.2	5,200
15	2.7	.....	4.2	.....	5.0	4,640
16	2.9	.....	4.1	.....	4.9	4,365
17	3.0	.....	4.0	.....	4.7	3,822
18	3.2	.....	3.9	.....	4.5	3,295
19	3.4	.....	3.9	.....	4.3	2,800
20	3.5	.....	3.8	.....	4.3	2,800
21	3.7	.....	3.7	.....	4.2	2,560
22	3.9	.....	3.8	.....	4.2	2,560
23	4.0	.....	3.8	.....	4.2	2,560
24	4.1	.....	3.9	.....	4.1	2,325
25	4.2	.....	3.9	.....	4.1	2,325
26	3.9	.....	4.0	.....	4.2	2,560
27	3.7	.....	4.1	.....	4.2	2,560
28	3.6	.....	4.2	.....	4.3	2,800
29	3.6	.....	4.3	.....	4.4	3,040
30	3.5	.....	4.4	.....	4.3	2,800
31	.....	.....	4.6	.....	.....	.....

NOTE.—Conditions at the gauging station changed during the flood in the early part of June, and the rating table does not apply until after the flood. (*a*) Maximum reached by the flood occurred on this date. The maximum gauge height was over 12 ft.

DAILY Gauge Height and Discharge of Waterton River, at Waterton Mills, Alta., for 1908—*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge heighgt.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	4.2	2,560	3.1	660	2.7	335	2.6	280
2	4.3	2,800	3.0	555	2.6	280	2.7	335
3	4.4	3,040	3 0	555	2.6	280	2.7	335
4	4.4	3,040	3.0	555	2.6	280	2.7	335
5	4.3	2,800	3.0	555	2.5	235	2.7	335
6	4.3	2,800	3.0	555	2.5	235	2.7	335
7	4.2	2,560	3,0	555	2.5	235	2.8	395
8	4.2	2,560	3.0	555	2.5	235	2.8	395
9	4.1	2,325	3.1	660	2.5	235	2.8	395
10	4.0	2,105	3.1	660	2.5	235	2.8	395
11	4.1	2,325	3.0	555	2.4	200	2.9	465
12	4.1	2,325	3.1	660	2.4	200	2.9	465
13	4.0	2,105	3.2	780	2.4	200	2.9	465
14	4.0	2,105	3.1	660	2.4	200	3.0	555
15	3.9	1,900	3.0	555	2.4	200	3.0	555
16	3.9	1,900	2.9	465	2.4	200	3.0	555
17	3.8	1,700	2.8	395	2.4	200	3.1	660
18	3.8	1,700	2.8	395	2.4	200	.....	.....
19	3.7	1,520	2.8	395	2.4	200	.....	.....
20	3.9	1,900	2.8	395	2.4	200	.....	.....
21	3.8	1,700	2.8	395	2.4	200	.....	.....
22	3.7	1,520	2.8	395	2.4	200	.....	.....
23	3.6	1,345	2.8	395	2.5	235	.....	.....
24	3.5	1,190	2.8	395	2.5	235	.....	.....
25	3.4	1,040	2.7	335	2.5	235	.....	.....
26	3.3	905	2.7	335	2.5	235	.....	.....
27	3.2	780	2.7	335	2.6	280	.....	.....
28	3.2	780	2.7	335	2.6	280	.....	.....
29	3.2	780	2.7	335	2.6	280	.....	.....
30	3.1	660	2.7	335	2.6	280	.....	.....
31	3.1	660	2.7	335	.....	.....	.....	.....

NOTE.—Conditions at the gauging station changed during the flood in the early part of June, and the rating table does not apply until after the flood.

DAILY Gauge Height and Discharge of Waterton River, at Waterton Mills, Alta., for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.6	280	4.9	4,365	4.3	2,800
2	.....	.....	2.7	335	5.3	5,490	4.2	2,560
3	.....	.....	2.7	335	5.6	6,414	4.3	2,800
4	.....	.....	3.1	660	5.5	6,100	4.4	3,040
5	.....	.....	3.1	660	5.4	5,790	4.5	3,295
6	.....	.....	3.1	660	5.2	5,200	4.6	3,555
7	.....	.....	3.2	780	5.0	4,640	4.4	3,040
8	.....	.....	3.2	780	5.0	4,640	4.3	2,800
9	2.4	200	3.2	780	4.9	4,365	4.2	2,560
10	2.4	200	3.3	905	4.9	4,365	4.1	2,325
11	2.4	200	3.3	905	4.8	4,090	4.0	2,105
12	2.5	235	3.4	1,040	4.9	4,365	3.9	1,900
13	2.5	235	3.4	1,040	5.0	4,640	3.9	1,900
14	2.6	280	3.4	1,040	5.0	4,640	3.8	1,700
15	2.6	280	3.4	1,040	5.1	4,917	3.8	1,700
16	2.5	235	3.3	905	5.1	4,917	3.8	1,700
17	2.5	235	3.3	905	5.2	5,200	3.7	1,520
18	2.5	235	3.4	1,040	5.2	5,200	3.7	1,520
19	2.6	280	3.4	1,040	5.3	5,490	3.7	1,520
20	2.6	280	3.5	1,190	5.5	6,100	3.7	1,520
21	2.5	235	3.5	1,190	5.6	6,414	3.5	1,190
22	2.5	235	3.6	1,345	5.4	5,790	3.4	1,040
23	2.5	235	3.6	1,345	5.1	4,917	3.4	1,040
24	2.5	235	3.9	1,900	4.9	4,365	3.3	905
25	2.5	235	4.2	2,560	4.7	3,822	3.3	905
26	2.5	235	4.4	3,040	4.6	3,555	3.3	905
27	2.5	235	4.7	3,822	4.4	3,040	4.2	2,560
28	2.5	235	4.7	3,822	4.3	2,800	4.4	3,040
29	2.6	280	4.7	3,822	4.3	2,800	4.6	3,555
30	2.6	280	4.8	4,090	4.3	2,800	4.4	3,040
31	.....	.....	4.8	4,090	.....	.....	4.1	2,325

DAILY Gauge Height and Discharge of Waterton River, at Waterton Mills, Alta., for 1909—*Concluded.*

Day.	August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	4.0	2,105	2.8	395	2.5	235	2.4	200
2	3.9	1,900	2.8	395	2.5	235	2.4	200
3	3.8	1,700	2.8	395	2.5	235	2.5	235
4	3.7	1,520	2.8	395	2.5	235	2.6	280
5	3.6	1,345	2.8	395	2.5	235	2.7	335
6	3.5	1,190	2.8	395	2.5	235	2.8	395
7	3.4	1,040	2.8	395	2.5	235	2.9	465
8	3.4	1,040	2.7	335	2.5	235	3.0	555
9	3.3	905	2.7	335	2.5	235	2.9	465
10	3.3	905	2.7	335	2.5	235	2.9	465
11	3.2	780	2.7	335	2.5	235	2.9	465
12	3.2	780	2.7	335	2.5	235	2.9	465
13	3.1	660	2.7	335	2.5	235	2.9	465
14	3.1	660	2.7	335	2.5	235	2.9	465
15	3.1	660	2.7	335	2.5	235	2.9	465
16	3.0	555	2.7	335	2.5	235	2.9	465
17	3.0	555	2.7	335	2.5	235	2.9	465
18	3.0	555	2.6	280	2.5	235	2.8	395
19	2.9	465	2.6	280	2.5	235	2.8	395
20	2.9	465	2.6	280	2.4	200	2.8	395
21	2.9	465	2.6	280	2.4	200	2.8	395
22	2.9	465	2.6	280	2.4	200	2.8	395
23	2.8	395	2.6	280	2.4	200	2.9	465
24	2.8	395	2.5	235	2.4	200	3.0	555
25	2.8	395	2.5	235	2.4	200	3.2	780
26	2.8	395	2.5	235	2.4	200	.....	.....
27	2.8	395	2.5	235	2.4	200	.....	.....
28	2.8	395	2.5	235	2.4	200	.....	.....
29	2.8	395	2.5	235	2.4	200	.....	.....
30	2.8	395	2.5	235	2.4	200	.....	.....
31	2.8	395	.....	.....	2.4	200	.....	.....

MONTHLY Discharge of Waterton River, at Waterton Mills, Alta., for 1908–9.

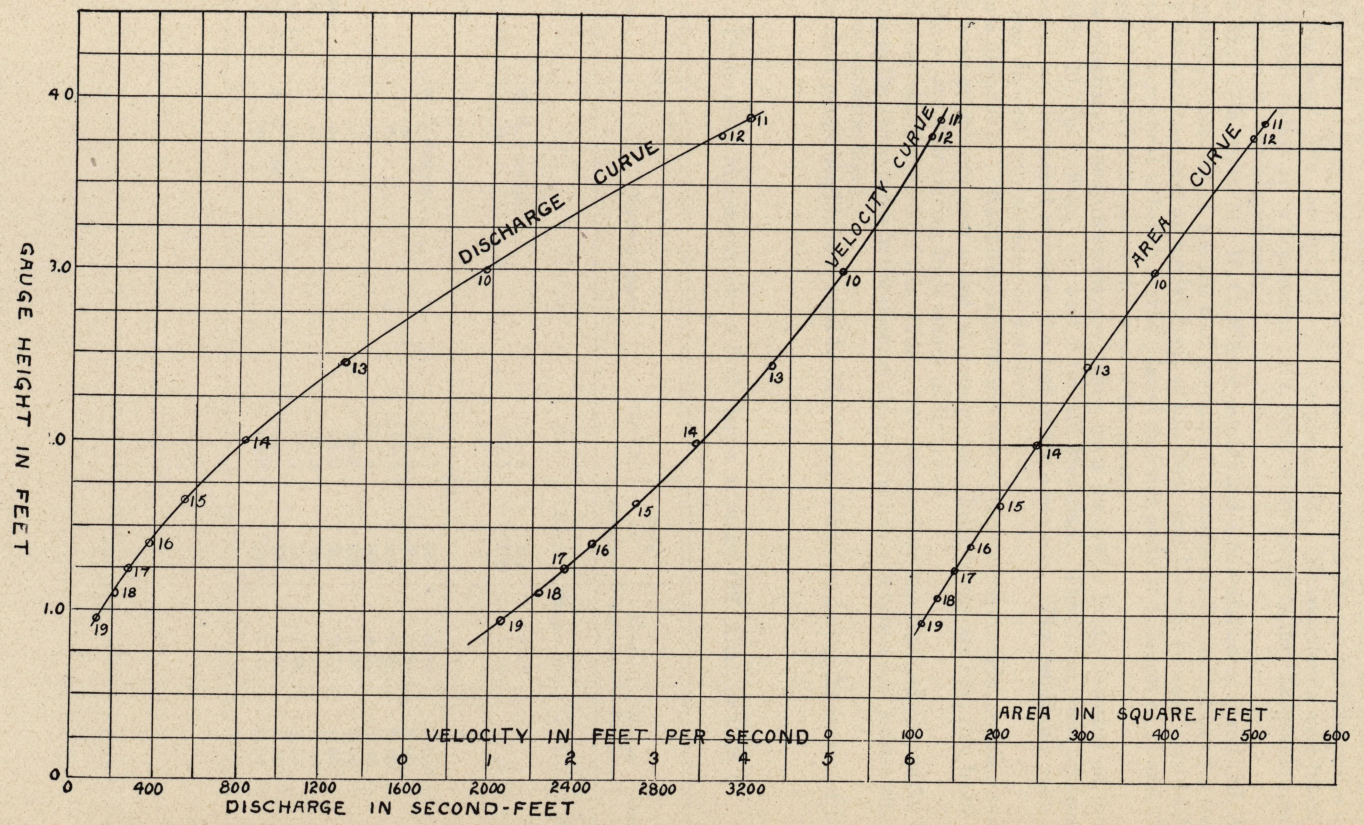
[Drainage area, 238 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage. area.	Total. in acre-feet.
1908.						
June (10-30)	7,750	2,325	3,811.4	16.014	12.507	158,755
July	3,040	660	1,852.6	7.784	8.974	113,910
August	780	335	485.3	2.039	2.351	29,841
September	335	200	234.8	0.986	1.100	13,973
October (1-17)	660	280	426.8	1.793	1.133	14,390
The period	.....	.....	.....	.....	.....	330,869
1909.						
April (9-30)	280	200	242.5	1.019	0.834	10,582
May	4,090	280	1,527.3	6.417	7.398	93,912
June	6,414	2,800	4,707.7	19.780	22.060	280,124
July	3,555	905	2.140.8	8.995	10.370	131,630
August	2,105	395	782.9	3.289	3.792	48,139
September	395	235	314.7	1.322	1.475	18,724
October	235	200	221.5	0.930	1.072	13,616
November (1-25)	555	200	425.0	1.785	1.659	21,074
The period	.....	.....	.....	.....	.....	617,801

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements in Waterton River drainage basin, in 1908–9.

Date.	Stream.	Locality.	Hydrographer.	Discharge.
1908.				*Sec.-ft.*
September 4	Oil Creek	Near mouth	H. C. Ritchie	14.4
1909.				
July 24	Oil Creek	Near mouth	H. C. Ritchie	85
August 16	....do	....do	....do	49.8
August 30	....do	....do	....do	30.1
September 16	....do	....do	....do	28.4
October 1	....do	....do	A. W. Pae	21.3
November 4	....do	....do	....do	25.6
July 24	Blakiston Brook	Sec. 30–1–29–4	H. C. Ritchie	120.0
August 16	....do	....do	....do	92.5
August 30	....do	....do	....do	48.2
September 16	....do	....do	....do	40.2
October 1	....do	....do	A. W. Pae	34.5
November 4	....do	....do	....do	35.4
July 24	Lost Creek	Sec. 5–2–29–4	H. C. Ritchie	23.2
November 5	Cottonwood Creek	Sec. 20–2–29–4	A. W. Pae	8.1
November 5	Pine Creek	Sec. 21–3–29–4	....do	7.8
August 31	Yarrow Creek	S. E 8–4–29–4	H. C. Ritchie	29.3
November 5	....do	....do	A. W. Pae	21.4
August 31	Drywood River	Sec. 17–4–29–4	H. C. Ritchie	28.4
November 5	....do	....do	A. W. Pae	14.5
August 16	Crooked Creek	Sec. 22–2–29–4	H. C. Ritchie	8.4
August 30	....do	....do	....do	6.6
September 15	....do	....do	....do	5.5
October 2	....do	....do	A. W. Pae	4.6
November 4	....do	....do	....do	6.7



DISCHARGE, AREA, AND MEAN-VELOCITY CURVES OF BELLY RIVER AT STANDOFF, ALTA., FOR 1909.

Belly River, at Stand Off, Alta.

A gauging station was established on the Belly River as early as 1906. Mr. J. F. Hamilton placed a gauge on the left bank of the river, within 200 yards of the police detachment at Big Bend, Alta., on the 18th of September, 1906. Measurements were taken in the vicinity of this station up to September 14th, 1908, when owing to the changeable conditions at the station it was abandoned.

On May 27th, 1909, Mr. H. C. Ritchie established a new station at Stand Off, Alta.

A gauge, consisting of a plain staff graduated to tenths and hundredths of a foot was securely fastened to a post on the left bank of the river, near George Pearson's out-buildings. The gauge is referred to bench marks, placed on fence posts at distances of 25 and 37 feet; elevations 7.49 and 8.35 above the zero of the gauge.

The discharge measurements are taken from the traffic bridge, located on the N.E. ¼ of Section 20, Tp. 6, Range 25, west of the 4th Meridian. The initial point for soundings was marked on the guard rail near the end of the approach. The remaining span of the bridge was divided into sections of five feet.

For a distance of 75 feet above and 60 feet below, the river is straight, running smoothly with an average velocity over a bed of clean gravel Both banks are low, free from brush and liable to overflow during high stages of the river.

Since the establishment of this station, the cross-section has changed very little, if any, but owing to the sharp turns in the channel the river is liable to take a new course altogether in times of extreme flood.

The daily gauge heights were read by Mr. George Pearson, during the season of 1909.

Discharge Measurements of Belly River at Stand-Off, Alta., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 3	H. R. Carscallen	101.5	281	3.27	.....	918
September 14	....do	85.5	138	1.50	.....	207
1909.						
May 27	H. C. Ritchie	104.5	384	5.14	3.005	1,971
June 3	....do	111.5	508	6.29	3.90	3,195
June 22	....do	111.5	496	6.20	3.80	3,072
June 30	....do	100.5	303	4.32	2.45	1,308
July 19	....do	94.7	246	3.37	2.00	830
August 10	....do	93.0	201	2.73	1.66	551
August 24	....do	91.5	169	2.19	1.40	371
September 10	....do	84.5	147	1.89	1.24	278
September 27	A. W. Pae	84.0	131	1.62	1.10	213
October 29	....do	83.0	109	1.14	0.94	125

Daily Gauge Height and Discharge of Belly River, at Stand-Off, Alta., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.2	2,245	2.4	1,235	2.5	1,350	1.3	310	1.2	255
2	.....	.....	3.3	2,380	2.3	1,130	2.5	1,350	1.3	310	1.2	255
3	.....	.....	3.5	2,650	2.6	1,465	2.4	1,235	1.3	310	1.2	255
4	.....	.....	4.0	3,330	2.7	1,585	2.3	1,130	1.3	310	1.15	230
5	.....	.....	3.8	3,055	2.6	1,465	2.3	1,130	1.3	310	1.15	230
6	.....	.....	3.8	3,055	2.6	1,465	2.2	1,025	1.3	310	1.1	205
7	.....	.....	4.0	3,330	2.5	1,350	2.1	925	1.3	310	1.1	205
8	.....	.....	3.9	3,190	2.4	1,235	2.0	830	1.3	310	1.1	205
9	.....	.....	3.8	3,055	2.5	1,350	1.7	580	1.3	310	1.15	230
10	.....	.....	3.4	2,515	2.4	1,235	1.7	580	1.25	282	1.2	255
11	.....	.....	3.1	2,105	2.3	1,130	1.6	505	1.25	283	1.15	230
12	.....	.....	3.0	1,975	2.2	1,025	1.6	505	1.25	282	1.1	205
13	.....	.....	3.1	2,105	2.2	1,025	1.6	505	1.25	283	1.1	205
14	.....	.....	3.2	2,245	2.1	925	1.6	505	1.25	282	1.1	205
15	.....	.....	3.2	2,245	2.1	925	1.6	505	1.25	283	1.1	205
16	.....	.....	3.3	2,380	2.1	925	1.5	435	1.2	255	1.1	205
17	.....	.....	3.4	2,515	2.0	830	1.5	435	1.2	255	1.05	180
18	.....	.....	3.4	2,515	2.0	830	1.5	435	1.2	255	1.05	180
19	.....	.....	3.5	2,650	2.0	830	1.5	435	1.2	255	1.05	180
20	.....	.....	3.9	3,190	2.0	830	1.5	435	1.2	255	1.0	155
21	.....	.....	4.2	3,610	2.0	830	1.5	435	1.2	255	1.0	155
22	.....	.....	3.9	3,190	2.0	830	1.45	402	1.2	255	1.0	155
23	.....	.....	3.7	2,920	1.9	740	1.45	403	1.15	230	1.0	155
24	.....	.....	3.4	2,515	1.9	740	1.4	370	1.15	230	1.0	155
25	.....	.....	3.2	2,245	1.9	740	1.4	370	1.15	230	1.0	155
26	3.0	1,975	3.2	2,245	1.8	655	1.4	370	1.1	205	1.0	155
27	3.0	1,975	2.8	1,710	2.0	830	1.4	370	1.1	205	0.95	132
28	3.2	2,245	2.7	1,585	3.0	1,975	1.35	340	1.1	205	0.95	133
29	3.2	2,245	2.6	1,465	3.0	1,975	1.35	340	1.15	230	0.95	132
30	3.1	2,105	2.5	1,350	2.7	1,585	1.3	310	1.15	230	0.95	133
31	3.0	1,975	.....	.....	2.6	1,465	1.3	310	.....	.....	0.95	132

Monthly Discharge of Belly River at Stand-Off, Alta., for 1909.

[Drainage area, 423 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
May (26–31)	2,245	1,975	2,086.7	4.933	1.101	24.833
June	3,330	1,350	2,518.8	5.954	6.643	149,881
July	1,975	655	1,134.0	2.680	3.090	69.730
August	1,350	310	608.2	1.438	1.658	37,398
September	310	205	267.8	0.633	0.706	15,937
October	255	132	189.3	0.447	0.515	11,637
The period	.....	.....	.....	.....	.....	309,416

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Belly River, at the traffic bridge on Sec. 1, Tp. 3, Range 28 west of the 4th Meridian, in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Sec.-ft.*
June 19	H. R. Carscallen	95	395	1617
July 1	....do	92	290	940
1909.				
May 29	H. C. Ritchie	100	398	2031

Mami Creek, at Mountain View, Alta.

The gauging station on Mami Creek was established by H. C. Ritchie, on August 13th, 1909.

The gauge which consists of a plain staff, graduated to feet and hundredths, is securely fastened to a pile of the traffic bridge on road allowance, north of Section 18, Tp. 2, Range 27, west of the 4th Meridian. The gauge is referred to a bench mark on the right bank; elevation 9.30 above zero of the gauge.

The channel curves for about 100 feet above the rod but below it is straight for about 200 feet. The bed is rocky, with clean sand and gravel. Both banks are clean, high and rocky but liable to overflow in heavy flood.

During high water the discharge measurements are taken from the traffic bridge, which is situated just below the junction of the east and west branches of the stream. All the water passes through the bridge in one channel. In low stages the east branch dries up and a wading section on the west branch, just above the junction, is used.

The gauge was read daily by Mr. James Cowcill, during 1909.

Discharge Measurements of Mami Creek, at Mountain View, Alta., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1909.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 24	H. C. Ritchie	10	23	2.15	.....	49.3
July 22	....do	9.4	15	3.89	.....	5.77
August 13	....do	9.0	14.6	0.41	1.94	6.03
August 27	....do	9.0	14.3	0.23	1.86	3.30
September 14	....do	7.0	2.3	0.83	1.84	1.92
September 30	A. W. Pae	7.0	1.9	0.87	1.85	1.65
November 2	....do	5.8	1.9	0.85	1.85	1.61

Note.—The flow of the East Branch of Mami Creek, at Mountain View was estimated to be 4.2 sec.-ft. on June 24th. On July 22nd it was almost dry and remained so until the close of the season's field work in that vicinity.

DAILY Gauge Height, in feet, of Mami Creek, at Mountain View, Alta., for 1909.

Day.	Aug.	Sept.	Oct.	Day.	Aug.	Sept.	Oct.
1	.....	1.8	1.8	16	1.9	1.8	1.8
2	.....	1.8	1.8	17	1.9	1.8	1.8
3	.....	1.8	1.8	18	1.9	1.8	1.8
4	.....	1.8	1.8	19	1.9	1.8	1.8
5	.....	1.8	1.8	20	1.8	1.8	1.8
6	.....	1.8	1.8	21	1.8	1.8	1.8
7	.....	1.8	1.8	22	1.8	1.8	1.8
8	.....	1.8	1.8	23	1.8	1.8	1.8
9	.....	1.8	1.8	24	1.8	1.8	1.8
10	.....	1.8	1.8	25	1.8	1.8	1.8
11	.....	1.8	1.8	26	1.8	1.8	1.8
12	.....	1.9	1.8	27	1.8	1.8	1.8
13	1.9	1.9	1.8	28	1.8	1.8	1.8
14	2.0	1.8	1.8	29	1.8	1.8	1.8
15	1.9	1.8	1.8	30	1.8	1.8	1.8
				31	1.8	.....	1.8

LEE CREEK, AT CARDSTON, ALTA.

A regular gauging station was established on Lee Creek by H. C. Ritchie, on June 28th, 1909. It is situated in the eastern portion of the town of Cardston, on the N.W. $\frac{1}{4}$ of Section 10, Tp. 3, Range 25, west of the 4th Meridian.

The gauge which consisted of a plain staff, graduated to tenths and hundredths of a foot, was securely fastened to the foot bridge, crossing the creek at this point. It was referred to a bench mark nearby; elevation 8.45. On the 28th of July, the foot bridge was washed out by the flood, taking the gauge with it. On August 11th, Mr. Ritchie put in a new gauge which he securely fastened to a post, placed in the right bank of the stream. This new location of the gauge is about 50 feet upstream from the old and is referred to a bench mark of elevation 8.40.

Before the flood, the discharge measurements were taken at a wading section near the foot bridge. Since establishing the new gauge, measurements have been taken at a wading station about 40 feet above the present location of the gauge; a permanent initial point for soundings being established by driving a stake into the right bank.

The channel is straight for about 100 feet above and 300 feet below the section. The bed is composed of a shallow layer of soft sand over a gravel foundation. The current which has a medium velocity is quite uniform. The right bank is a high clay cut while the left is low and stony and liable to overflow during high water.

The discharge measurements taken during the season were quite satisfactory, but owing to the change in gauges and cross-section, there is a break in the records from July 27th to August 11th. The gauge was read daily by Mr. Sterling Williams.

Discharge Measurements of Lee Creek, at Cardston, Alta.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 24	H. C. Ritchie	.....	.....	.....	.....	216
July 1	H. R. Carscallen	.....	.....	.....	.....	149
September 2	H. C. Ritchie	13.2	7.6	1.76	.....	13.5
September 15	H. R. Carscallen	21.5	14.4	0.79	.....	11.4
1909.						
June 2	H. C. Ritchie	93.0	130.7	3.97	.....	518.5
June 28	....do	63.9	78.8	2.72	2.35	213.3
July 20	....do	60.0	46.0	1.36	1.85	62.6
August 11	....do	62.2	41.9	1.54	1.75	64.7
August 25	....do	59.5	27.2	1.13	1.55	30.8
August 25	....do	59.5	27.2	1.05	1.55	28.7
September 11	....do	34.7	30.0	1.15	1.56	34.4
September 28	A. W. Pae	33.6	23.3	0.79	1.46	18.4
October 29	....do	33.1	22.2	0.71	1.45	15.9

Daily Gauge Height and Discharge of Lee Creek, at Cardston, Alta., for 1909.

Day.	June.		July.		August.		September.		October.		November.	
	Gauge Height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.30	198.0	.....	.....	1.50	23.0	1.40	10.0	1.38	7.0
2	.....	.....	2.30	198.0	.....	.....	1.50	23.0	1.40	10.0	1.38	7.0
3	.....	.....	2.20	166.0	.....	.....	1.52	26.0	1.40	10.0	1.40	10.0
4	.....	.....	2.20	166.0	.....	.....	1.54	29.0	1.40	10.0	1.42	12.0
5	.....	.....	2.20	166.0	.....	.....	1.52	26.0	1.40	10.0	1.45	16.5
6	.....	.....	2.40	230.0	.....	.....	1.50	23.0	1.38	7.0	1.44	15.0
7	.....	.....	2.20	166.0	.....	.....	1.48	20.0	1.39	8.5	1.43	13.5
8	.....	.....	2.20	166.0	.....	.....	1.46	18.0	1.40	10.0	1.42	12.0
9	.....	.....	2.20	166.0	.....	.....	1.44	15.0	1.40	10.0	1.40	10.0
10	.....	.....	2.10	136.0	.....	.....	1.40	10.0	1.40	10.0	1.40	10.0
11	.....	.....	2.10	136.0	1.70	55.0	1.50	23.0	1.42	12.0	.....	.....
12	.....	.....	2.10	136.0	1.70	55.0	1.60	39.0	1.42	12.0	.....	.....
13	.....	.....	2.10	136.0	1.70	55.0	1.54	29.0	1.40	10.0	.....	.....
14	.....	.....	2.10	136.0	1.70	55.0	1.52	26.0	1.40	10.0	.....	.....
15	.....	.....	2.00	106.0	1.70	55.0	1.50	23.0	1.40	10.0	.....	.....
16	.....	.....	2.00	106.0	1.60	39.0	1.48	20.0	1.40	10.0	.....	.....
17	.....	.....	2.00	106.0	1.60	39.0	1.44	15.0	1.41	11.0	.....	.....
18	.....	.....	1.90	77.0	1.60	39.0	1.50	23.0	1.42	12.0	.....	.....
19	.....	.....	1.90	77.0	1.60	39.0	1.50	23.0	1.41	11.0	.....	.....
20	.....	.....	1.90	77.0	1.60	39.0	1.48	20.0	1.40	10.0	.....	.....
21	.....	.....	1.80	48.0	1.60	39.0	1.48	20.0	1.40	10.0	.....	.....
22	.....	.....	1.80	48.0	1.60	39.0	1.46	18.0	1.40	10.0	.....	.....
23	.....	.....	1.80	48.0	1.50	23.0	1.45	16.5	1.41	11.0	.....	.....
24	.....	.....	1.80	48.0	1.50	23.0	1.44	15.0	1.43	13.5	.....	.....
25	.....	.....	1.80	48.0	1.50	23.0	1.43	13.5	1.42	12.0	.....	.....
26	.....	.....	1.80	48.0	1.50	23.0	1.42	12.0	1.41	11.0	.....	.....
27	.....	.....	.....	.....	1.50	23.0	1.41	11.0	1.40	10.0	.....	.....
28	2.30	198.0	.....	.....	1.50	23.0	1.40	10.0	1.40	10.0	.....	.....
29	2.30	198.0	.....	.....	1.50	23.0	1.40	10.0	1.38	7.0	.....	.....
30	2.30	198.0	.....	.....	1.50	23.0	1.40	10.0	1.38	7.0	.....	.....
31	.....	.....	.....	.....	1.50	23.0	.....	.....	1.38	7.0	.....	.....

Note.—Gauge was established June 28th, carried out by flood on July 27th, and re-established August 11th.

MONTHLY Discharge of Lee Creek at Cardston, Alta., for 1909.

[Drainage area, 103 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
June (28–30)	198.0	198.0	198.0	1.922	0.214	1,178
July (1–26)	230.0	48.0	120.7	1.172	1.133	6,226
August (11–31)	55.0	23.0	35.9	0.349	0.272	1,497
September	39.0	10.0	19.7	0.191	0.213	1,170
October	13.5	7.0	10.1	0.098	0.113	619
November (1–10)	16.5	7.0	11.3	0.109	0.040	224
The period	.....	.....	.....	.....	.....	10,914

ST. MARY RIVER, AT KIMBALL, ALTA.

This station was estabilshed by the Alberta Railway and Irrigation Company, in 1905. It is located on Section 25, Tp. 1, Range 25, west of the 4th Meridian, about one half mile above the company's dam and headgate.

The channel is straight for 450 feet above and 400 feet below the station. Both banks are high and not liable to overflow. The right bank is partly covered with scrub above the station, but at and below the station it is clear. The bed of the stream is of gravel and is liable to slight changes. Since the flood of 1908, the cross-section and current are quite uniform.

Discharge measurements are made by means of a cable, car and tagged wire. The initial point for soundings is the zero of the tagged wire, which is 44.8 feet from the inside edge of the cable support on the right bank.

The gauge, which is a plain staff, graduated to feet and tenths, is set in the right bank, a few feet above the cable. A trench lined with plank, connects a stilling box about the gauge with the channel in low water. The zero of the gauge is 14.12 feet below the top of the east end of the lower sill of the cable support, on the right bank.

In 1908, the gauge was read by E. D. Mallery, and in 1909, by J. M. Dunn.

Discharge Measurements of St. Mary River, at Kimball, Alta., in 1906–7–8–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1906.						
September 22	J. F. Hamilton	224	264	1.92	.....	508
1907.						
August 3	I. J. Walmsley	230	503	4.03	4.20	2,026
1908.						
June 29	H. R. Carscallen	224	730	3.82	4.13	2,788
September 1	P. M. Sauder	219	323	1.60	2.45	519
September 16	H. R. Carscallen	219	339	1.71	2.50	579
1909.						
May 20	H. C. Ritchie	221	526	2.91	3.30	1,532
June 1	....do	227.5	930	5.11	5.005	4,752
June 26	....do	229	933	4.81	5.075	4,490
June 29	....do	227	841	4.19	4.71	3,525
July 21	....do	224.5	635	3.10	3.80	1,969
August 12	....do	222	542	2.56	3.40	1,389
August 26	....do	222	437	1.96	3.00	858
September 13	....do	221	396	1.76	2.85	698
September 29	A. W. Pae	218.5	359	1.40	2.65	505
November 1	....do	218	308	0.98	2.35	305

Daily Gauge Height and Discharge of St. Mary River, at Kimball, Alta., for 1908.

Day.	April.		May.		June.		July.		August.		September.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.72	.....	5.57	.....	4.00	2,565	3.20	1,390	2.50	575
2	.....	.....	3.7	.....	5.62	.....	4.02	2,598	3.17	1,351	2.46	535
3	.....	.....	3.7	.....	5.45	.....	4.20	2,900	3.10	1,260	2.47	545
4	.....	.....	3.76	.....	7.77	.....	4.20	2.900	3.10	1,260	2.43	505
5	.....	.....	3.8	.....	10.25	.....	4.25	2,987	3.02	1.160	2.37	446
6	.....	.....	3.9	.....	9.70	.....	4.27	3,022	3.00	1,135	2.31	389
7	.....	.....	4.05	.....	8.55	.....	4.05	2,647	3.00	1,135	2.37	446
8	.....	.....	4.27	.....	7.7	.....	4.05	2,647	3.00	1,135	2.42	495
9	.....	.....	4.42	.....	7.0	.....	4.12	2,764	2.97	1,099	2.43	505
10	.....	.....	4.45	.....	6.6	.....	4.10	2,730	2.90	1,015	2.50	575
11	.....	.....	4.45	.....	6.37	.....	4.12	2,764	2.90	1,015	2.45	525
12	.....	.....	4.6	.....	6.25	.....	4.10	2,730	2.87	980	2.45	525
13	2.85	.....	4.65	.....	5.9	.....	4.02	2,598	2.85	957	2.45	525
14	2.9	.....	4.75	.....	5.65	.....	4.17	2,849	2.85	957	2.45	525
15	2.9	.....	4.72	.....	5.52	.....	4.10	2,730	2.82	923	2.50	575
16	2.9	.....	4.77	.....	5.42	.....	4.05	2,647	2.73	822	2.50	575
17	3.05	.....	4.57	.....	5.35	.....	4.07	2,680	2.70	788	2.50	575
18	3.25	.....	4.37	.....	5.25	.....	4.02	2,598	2.70	788	2.50	575
19	3.47	.....	4.32	.....	4.95	.....	3.85	2,326	2.70	788	2.55	627
20	3.62	.....	4.35	.....	4.77	.....	3.80	2,248	2.70	788	.....	.....
21	3.77	.....	4.25	.....	4.62	3,669	3.77	2,202	2.77	866	.....	.....
22	3.85	.....	4.2	.....	4.47	3,384	3.70	2,095	2.80	900		
23	3.92	.....	4.2	.....	4.32	3,111	3.74	2,156	2.80	900	.....	.....
24	4.0	.....	4.25	.....	4.20	2,900	3.71	2,110	2.77	866	.....	.....
25	4.05	.....	4.3	.....	4.25	2,987	3.65	2,020	2.75	844	.....	.....
26	4.0	.....	4.5	.....	4.37	3,201	3.57	1,901	2.72	810	.....	.....
27	4.0	.....	4.87	.....	4.42	3,292	3.48	1,772	2.67	756	.....	.....
28	3.87	.....	4.62	.....	4.30	3,075	3.42	1,688	2.65	734	.....	.....
29	3.52	.....	4.47	.....	4.15	2,815	3.33	1,564	2.62	702	.....	.....
30	3.77	.....	4.52	.....	4.05	2,647	3.22	1,417	2.55	627	.....	.....
31	.....	.....	4.82	.....	.....	.....	3.20	1,390	2.52	596	.....	.....

Highest stage was on June 5th when the maximum gauge height was over 11 feet. On account of changing conditions during the flood the rating table could not be applied to gauge heights previous to June 21st.

DAILY Gauge Height and Discharge of St. Mary River, at Kimball, Alta., for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.2	290	5.1	4,978	4.65	3,415
2	.....	.....	2.6	680	5.5	5,985	4.85	3.797
3	.....	.....	3.1	1,260	5.8	6,780	4.8	3,700
4	.....	.....	3.2	1,390	5.8	6,760	4.8	3,700
5	.....	.....	3.0	1,135	5.8	6,720	4.85	3,797
6	.....	.....	2.8	900	5.75	6,560	4.95	3,992
7	.....	.....	2.7	788	5.55	6,010	4.85	3,797
8	.....	.....	2.8	900	5.6	6,120	4.75	3,605
9	.....	.....	2.85	957	5.65	6,240	4.55	3,227
10	.....	.....	3.0	1,135	5.35	5,420	4.45	3,047
11	.....	.....	3.0	1,135	5.25	5,170	4.4	2,960
12	.....	.....	2.9	1,015	5.1	4,790	4.4	2,960
13	.....	.....	2.95	1,075	5.15	4,870	4.35	2,875
14	.....	.....	3.0	1,135	5.35	5,355	4.3	2,790
15	.....	.....	3.15	1,325	5.5	5,730	4.25	2,705
16	.....	.....	3.15	1,325	5.65	6,105	4.1	2,455
17	.....	.....	3.05	1,197	5.7	6,210	4.05	2,372
18	.....	.....	3.1	1,260	5.8	6,480	4.1	2,455
19	.....	.....	3.3	1,525	5.85	6,600	3.95	2,207
20	.....	.....	3.45	1,745	6.1	7,280	3.9	2,125
21	.....	.....	3.5	1,820	6.1	7,260	3.8	1,970
22	.....	.....	3.8	2,310	5.85	6,545	3.7	1,820
23	.....	.....	3.95	2,575	5.65	5,990	3.7	1,820
24	.....	.....	4.0	2,665	5.45	5.420	3.7	1,820
25	.....	.....	4.25	3,125	5.25	4,910	3.7	1,820
26	2.5	575	4.45	3,522	5.05	4,490	3.85	2,047
27	2.5	575	4.55	3,729	4.85	3,965	4.6	3,320
28	2.4	475	4.7	4,045	4.75	3,700	5.95	6,167
29	2.35	427	4.85	4,380	4.7	3,510	5.5	5,140
30	2.4	475	4.85	4,380	4.65	3,415	5.1	4,290
31	.....	.....	4.85	4,380	.....	.....	4.85	3,797

DAILY Gauge Height and Discharge of St. Mary River, at Kimball, Alta., for 1909.—*Con.*

Day.	August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
Month.	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	4.7	3,510	2.9	760	2.7	565	2.4	340
2	4.45	3,047	2.9	760	2.7	565	2.4	340
3	4.35	2,875	2.9	760	2.7	565	2.4	340
4	4.15	2,537	2.9	760	2.7	565	2.7	565
5	4.0	2,290	2.9	760	2.7	565	2.95	815
6	3.85	2,047	2.9	760	2.7	565	3.0	870
7	3.8	1,970	2.9	760	2.7	565	2.95	815
8	3.7	1,820	2.8	655	2.7	565	3.0	870
9	3.6	1,675	2.8	655	2.65	522	2.95	815
10	3.5	1,530	2.8	655	2.6	480	2.95	815
11	3.5	1,530	2.95	815	2.6	480	2.9	760
12	3.4	1,385	2.9	760	2.6	480	2.8	655
13	3.4	1,385	2.9	760	2.6	480	2.8	655
14	3.35	1,315	2.8	655	2.6	480	2.8	655
15	3.3	1,245	2.8	655	2.6	480	2.8	655
16	3.3	1,245	2.8	655	2.6	480	2.8	655
17	3.25	1,180	2.8	655	2.5	405	2.85	707
18	3.2	1,115	2.8	655	2.5	405	2.85	707
19	3.2	1,115	2.8	655	2.5	405	2.9	760
20	3.1	990	2.75	610	2.5	405	3.0	870
21	3.1	990	2.7	565	2.5	405	.....	.....
22	3.1	990	2.7	565	2.5	405	.....	.....
23	3.05	930	2.7	565	2.5	405	.....	.....
24	3.0	870	2.7	565	2.5	405	.....	.....
25	3.0	870	2.6	480	2.5	405	.....	.....
26	3.0	870	2.6	480	2.4	340	.....	.....
27	3.0	870	2.6	480	2.4	340	.....	.....
28	3.0	870	2.6	480	2.4	340	.....	.....
29	3.0	870	2.6	480	2.4	340	.....	.....
30	2.9	760	2.65	522	2.4	340	.....	.....
31	2.9	760	.....	.....	2.35	307	.....	.....

Monthly Discharge of St. Mary River at Kimball, Alta., for 1908.

[Drainage area, 472 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
June (21-30)	3,669	2,647	3,108.1	6.585	2.449	61,648
July	3,022	1,390	2,395.0	5.074	5.850	147,265
August	1,390	596	946.7	2,006	2.313	58,210
September (1-19)	627	389	528.6	1.120	0.791	19,921
The period	.....	.....	.....	.....	.....	287,044
1909.						
April (26-30)	575	427	505.4	1.078	0.200	5,012
May	4,380	290	1,906.5	4.039	4.657	117,225
June	7,280	3,415	5,645.6	11.961	13.335	335,936
July	6,167	1,820	3,096.5	6.560	7.563	190,397
August	3,510	760	1,466.3	3.107	3.582	90,160
September	815	480	644.7	1.366	1.524	38,362
October	565	307	453.3	0.960	1.107	27,872
November (1-20)	870	340	683.2	1.447	1.076	27,102
The period	.....	.....	.....	.....	.....	832,066

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Alberta Railway and Irrigation Company's Canal, near Kimball, Alta., in 1908–9.

Date.	Hydrographer.	Measurement at	Discharge.
1908.			*Sec.-ft.*
September 1	P. M. Sauder	Flume over Rolph Creek.	189
September 16	H. R. Carscallen	....do	411
1909.			
June 1	H. C. Ritchie	Flume over Rolph Creek.	138
June 26	....do	Bridge No. 1	611
November 1	A. W. Pae	....do	228

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15″ Weir used in Maple Creek District.

REPORT

ON

STREAM MEASUREMENTS IN MAPLE CREEK DISTRICT

SUBMITTED TO

THE CHIEF HYDROGRAPHER, DEPARTMENT OF INTERIOR

BY

H. R. CARSCALLEN, B. A. Sc., District Hydrographer

FEBRUARY 10TH, 1910.

DEPARTMENT OF THE INTERIOR,
Hydrographic Surveys,
CALGARY, Alta., February 10, 1910.

P. M. SAUDER, Esq.,
Chief Hydrographer.

SIR,—I beg to submit herewith my report of hydrographic work accomplished in the Maple Creek district during the season of 1909.

In accordance with your instructions, dated May 8, I proceeded to Maple Creek and took over the outfit stored there by Mr. F. T. Fletcher.

On May 11, work was begun and carried on to November 25, when the party was recalled.

GENERAL FEATURES OF DISTRICT.

The Maple Creek district, from a hydrographic standpoint, is comprised of a number of streams all of which have their source in the Cypress hills, This comparatively high range of hills lies south of the main line of the Canadian Pacific Railway in the south western part of Saskatchewan and extends for some distance into Alberta. These hills have a drainage in three general directions, viz.—north into a series of lakes lying between the Canadian Pacific Railway and the Sand Hills; east into the South Saskatchewan river by way of Swiftcurrent creek; south into Milk river. A continuation of the Cypress Hills proper has, in addition, a drainage west and north into the South Saskatchewan by way of the Sevenpersons River.

The greater part of the drainage area of the Cypress Hills is devoid of tree growth, although most of the streams themselves and the coulees draining into them are densely covered with brush and in some localities with fair-sized timber. As an outcome of this scarcity of tree growth the streams are subject to violent floods of short duration and reach a low stage, some of them becoming perfectly dry in midsummer. The fall or slope of the beds of most of the streams is very considerable and this explains, in part, the fast run-off of flood water. It is very evident that there is great necessity for reservoirs along the streams in order that the flood water may be stored up and the flow equalized during the summer months, when it is most needed. The hills are entirely of earth and gravel formation and for this reason the streams are constantly changing their course, or shifting their beds. This fact, together with the extreme floods to which they are subject, makes the selection of a permanent cross-section for gauging purposes a very difficult one. Many of the streams have a sub-surface flow which materially affects the accuracy of discharge measurements made at low-water stages. In many cases the stream will disappear altogether and leave the bed perfectly dry, the flow reappearing again perhaps miles below. This is particularly the case with Fairwell and Middle Creeks and the fact points out the necessity for a thorough investigation and study of such streams and the causes of these peculiarities of flow, especially as there are so many small irrigation rights registered against them which require a thorough knowledge of this flow in order to administer their water supply with justice.

In the case of the streams draining into the Frenchman River much annoyance was caused during the season of 1909 by the work of beavers. In the first place they hamper the hydrographer in his reconnaissance for gauging stations, the selection of many of the very best sites being prohibited by beaver dams constructed below the section. Then again they may construct their dams below a station already established, thus raising the water at the gauge above its normal level and possibly destroying the usefulness of previous records.

Past Work in the Maple Creek District.

As far as could be learned the first work of this kind carried on in the Maple Creek district was in 1897, when miscellaneous gaugings of Willow (Lodge) Creek, Medicine-Lodge Creek, Battle Creek and Belanger Creek were made and high-water and flood discharges computed (see General Report on Irrigation and Canadian Irrigation Surveys for 1897-8). In 1898 gauge heights were placed on Canadian Pacific Railway bridges spanning the following nine creeks:—Maple, Fish, (Gap), McKay, Boxelder, Piapot, Swiftcurrent, Sevenpersons, Bullshead and Ross. Daily gauge height observations were recorded during a short period of the summer of 1898 and, from these, curves showing the rise and fall of the streams during the period of observations were made, (see General Report for 1897-8). No discharge measurements, however, were obtained at these stations during the season and hence no rating curves could be constructed. For several years Mr. R. J. Burley, irrigation inspector, has made miscellaneous gaugings on a great number of the streams in conjunction with his inspections. In 1908 Mr. Burley established gauge heights on the following streams, obtaining several gaugings and daily records of gauge heights on each:—Maple Creek, Piapot Creek, Bear Creek, Skull Creek, Bone Creek, Frenchman River, North Fork of Frenchman River and Enright and Strong's Irrigation Ditch. In the spring of 1909 Mr. F. T. Fletcher established permanent gauging stations on three streams—Hay, Gap and McShane Creeks. He obtained a number of discharge measurements at these stations as well as at those established by Mr. Burley the previous season. Later in the season Mr. Fletcher under the direction of Mr. Burley established the gauging station on Battle Creek at Tenmile.

Equipment of Party.

The party consisted of the hydrographer and a helper. The district was covered by means of a team and democrat; owing to the scarcity of accommodation a small camp outfit was provided. The chief instruments used were:—an engineers level, a large Price electric meter, a small Price acoustic meter and a 15″ steel weir.

Reconnaissance.

This part of the work consists in exploring the streams with a view to obtaining locations suitable for permanent gauging stations. A special trip covering all the important streams could not be made owing to the necessity of obtaining periodical gaugings of streams on which permanent gauging stations were already established and also owing to the limited time allowed for each trip. The latter condition was due to the fact that grain for the team and other supplies for the entire trip had to be hauled from Maple Creek, it being impossible to obtain such supplies from the ranchers along the route. The method followed was to make a reconnaissance of one or more creeks each trip, carrying on the regular work of gauging at the same time. In this way this part of the work was spread over the greater part of the season. In addition to the reconnaissance of streams along the regular route. trips were made by train to Walsh, Irvine, Medicine Hat and Swiftcurrent and the following creeks were explored in the vicinity of these places with a view to obtaining locations for permanent gauging stations:—Boxelder, McKay, Stony, Ross, Bullshead, Gros Ventre, Sevenpersons and Swiftcurrent. The interval from October 1 to November 4 was spent with Mr. Burley's inspection camp with the object of becoming familiarized with the country and streams to the south and west of the regular route. In this trip Middle Creek was followed to within a short distance of its junction with Lodge Creek. Crossing Lodge Creek at the mouth of Bear Creek, the camp moved down into the Wild Horse Lake district. After completing his inspections in this district Mr. Burley moved the camp back to Middle Creek, following it up to within a short distance of the Fourth Meridian. Middle Creek was found to be perfectly dry near the Alberta boundary but started running in Sec.

30, Tp. 5, R. 29 W. of 3rd meridian and continued to have small discharge at all points below, visited during the trip. Lodge Creek was not running but had water standing in pools, while Bear and Sage Creeks were perfectly dry at this time.

On July 8 and again on September 22, a reconnaissance trip was made to the forks of the Swiftcurrent Creek on Sec. 18, Tp. 10, R. 19, w. of 3rd meridian with the object of locating a suitable gauging station on the creek below the forks. Mr. K. Sinclair's ranch is located within a mile of the forks but owing to his absence on both dates no arrangements could be made regarding gauge height observations. Should Mr. Sinclair be willing to make such observations a chain gauge could be established on the new government bridge at the forks.

Work Done During the Season.

From May 10 to October 1, in addition to the reconnaissance work mentioned under the previous heading, seven complete rounds of the district were made; gaugings being taken at all the regular stations and miscellaneous measurements on a number of less important streams. During this time permanent gauging stations were established on fourteen streams as follows:—East Branch of Bear Creek, West Branch of Bear Creek, Bridge Creek near its source, Swiftcurrent Creek near its source, Jones Coulee, Fairwell Creek, Davis Creek, Belanger Creek, Sucker Creek, Lone Pine Creek, Oxarart Creek Middle Creek, Tenmile Creek and Six Mile Coulee. After leaving Mr. Burley's camp on November 4, an additional round of the regular stations was made with the main object of preparing them, in the best manner possible, to withstand the action of frost and moving ice in the following spring.

Establishment of Stations.

With but one exception, i.e. the station on Bridge or Thirty-two Mile Creek, all gauging stations established in the district during the past season were wading stations and the method of procedure was practically the same in all cases. A hole about two feet deep was dug in the bed of the stream at one of its banks. Then a post at least six inches through and from twelve to fourteen feet in length was placed in the hole; the gauge height, a plain staff graduated to feet and hundredths, was spiked securely to the post and the hole filled in with gravel and large stones. Two large stakes, about four inches through, were driven into the ground from ten to twelve feet apart. Stout timber braces were then secured to the stakes and to the post in the form of a V. In some cases anchors were nailed to the bottom of the posts while in others two stout stakes were driven slantingly into the bank and spiked to the post near its base. Large stones, earth and gravel were packed between these stakes. Then the gauge height was referred to bench marks, a cross-section of the station was developed and the initial and final points permanently marked.

The station established on Bridge Creek was a bridge station, the gauge height in this case being attached vertically to a centre pile of the bridge.

Method of Discharge Measurements.

The large electric meter is suitable only for large streams flowing at a fairly high rate of speed, owing to the amount of water which it displaces and also to the velocity required to overcome the friction. The majority of the streams in this district have very small discharges during the greater part of the season and for this reason the large meter was of service only while the streams were in flood. At low stages it was necessary to use either the acoustic meter or a weir. The acoustic meter is suitable for shallow streams having fairly high velocities. Many of the streams when at low stages have velocities too small to be accurately recorded by the acoustic meter and results obtained in these cases were unsatisfactory. The weir used was a 15″ x 4″, capable of measuring discharges of approximately one sec.-ft. and under and was found very useful and accurate.

The method of procedure in making discharge measurements is briefly described below under two headings—current meter measurements and weir measurements.

Current meter measurements.—The cross-section is divided into a number of equal parts varying in length from one-half to five feet, depending on the size of the stream. At each point of division the depth and mean velocity of the water are recorded. In all cases of meter measurements the one-point method of obtaining mean velocity was employed. This method, which is the result of many experiments carried on by the U.S. Geological Survey, assumes that the thread of mean velocity in any vertical is at six-tenths the depth of the stream.

Weir measurements.—In making a weir measurement a suitable place for the immersion of the weir is selected. The weir is then placed in the stream at right angles to the direction of flow and as nearly level as possible. It is packed firmly with sods in order that no leakage may occur and that the full discharge of the stream flows over its crest. When the stream has adjusted itself to the change in slope due to the presence of the weir, the head of water is taken by means of an engineer's level. The rod is held on the crest of the weir and also at water level beyond the velocity of approach (approximately six feet above, for a 15″ weir), the readings being subtracted to give the head on the weir.

Computations.

Current meter measurements.—As described under the previous heading, the cross-section is divided into elementary strips. The mean velocity, area and discharge are determined separately for each strip; the total discharge and area are found by summing those for the various strips; and the mean velocity is found by dividing the total discharge by the total area.

Weir measurements.—A rectangular, sharp-crested weir, having complete end contractions, was used in all cases of weir measurement. The Francis formula, $Q = 3.33 (L - .2H) H^{\frac{3}{2}}$, was used in the computation. This formula neglects the velocity of approach the percentage of error resulting being so small that it is practically negligible.

Discussion of Data.

The office work of plotting cross-sections and discharge rating curves for the streams of the Maple Creek district shows that in the majority of cases the beds of the streams shift more or less during flood stages. Hence, whenever a change occurs a new rating curve must be plotted and sufficient measurements must be made in the field while conditions remain unchanged in order that a rating curve may be plotted which will cover the range of daily gauge heights obtained during this time. Another condition affecting the accuracy of records is that, with few exceptions, the gauge heights are read to the nearest tenth or half-tenth of a foot. This is due to the difficulty in explaining the decimal marking of the gauges. For this reason approximate results only are obtainable in the case of very small streams.

Division of District.

It has been suggested that the Maple Creek district be divided and another hydrographer placed in this country with an outfit similar to that operated during the past season. The presence of another hydrographer in the district would insure more high-water and flood measurements; also the smaller districts could be covered in a much more thorough manner and with less hardship to the horses.

During the latter part of the season when the streams are low and changes in stage take place slowly the gauging stations need not be visited at such frequent intervals. Thus the hydrographer on his trips may have time to make reconnaissances along the streams in his district with a view to establishing new permanent stations and to bettering the locations of stations already established. Investigations could be made as to the reasons for the

disappearance of water in some localities on such creeks as Middle and Fairwell, as mentioned above, and a thorough knowledge of the flow of these streams could be obtained. As to the method of dividing the district I would propose the following:—to divide the district into two sub-districts, an eastern and a western, both hydrographers to make their headquarters at Maple Creek. The eastern district would be made up of all streams east of Hay Creek, north of the hills, and east of Fairwell Creek, south of the hills; the western district would be made up of all creeks west of and including Hay Creek, north of the hills, and west of and including Fairwell Creek, south of the hills.

The division is rather hard to make at present as both hydrographers would be forced to outfit from some point or points along the main line of the Canadian Pacific Railway and the district does not divide itself naturally to conform to this condition. However, when the proposed line of the Canadian Pacific Railway from Weyburn to Lethbridge comes into operation it will in all probability skirt the southern boundary of this district and allow that portion to be worked from some point along this new line of railway.

The division suggested above would allow of a train trip for each hydrographer, one west to Medicine Hat and one east as far as Swiftcurrent, thus giving the team in charge of each hydrographer a much-needed rest.

In gathering together data for the appended report use was made of all measurements taken by Mr. Burley during the season of 1908 at or in the vicinity of permanent gauging stations.

Your obedient servant,

H. R. CARSCALLEN.

Middle Creek at Maurice Ross' Ranche.

This station was established July 20, 1908, by H. R. Carscallen. It is located on Section 30, Tp. 5, R. 29, west of the 3rd meridian, about four miles from Battle Creek post office.

The channel is straight for 50 feet above and below the station. The right bank is high but the left is low and liable to overflow in flood stages of the stream. The bed of the stream is composed of sand and coarse gravel with a little vegetation at the section, and probably shifts slightly during high water. There is only one channel at low stages but in extreme flood stages water breaks out over the left bank and forms two channels. The current is sluggish at low stages and moderate at higher stages.

Discharge measurements are made by wading at moderate stages and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked L. P. 0.0.

The gauge, which is read once each day by Mr. Ross is a 2″ x 2″ x 10′ staff nailed to a pine post sunk in the bed of the creek at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) The top of the final point stake driven close to the ground on the right bank and marked B. M. in red paint; elevation, 5.91 feet above the zero of the gauge. (2) The heads of three spikes driven into the top of the ground-log between the stable and the hen-house facing the gauge and marked B. M. in red paint; elevation, 10.63 feet above the zero of the gauge.

Gauge in Middle Creek at Ross' Ranche.
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Discharge Measurements of Middie Creek at Ross' Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 16	H. R. Carscallen	5.0	1.04	0.490	.....	0.51
July 1	....do	7.0	1.91	1.126	.....	2.15
July 20	....do	1.25	*	0.21	0.78	0.39
August 9	....do	1.25	*	0.187	0.76	0.33
September 8	....do	1.25	*	0.21	0.79	0.39
September 29	....do	3.0	0.99	0.576	0.825	0.57
November 4	....do	1.25	*	0.10	0.75	0.13

*Weir measurements.

Daily Gauge Height and Discharge of Middle Creek at Ross' Ranche, for 1909.

Day.	July.		August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
2	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
3	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
4	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
5	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
6	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
7	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
8	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
9	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
10	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
11	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
12	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
13	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
14	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	0.8	0.36
15	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
16	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
17	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
18	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
19	.....	.....	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
20	0.8	0.46	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
21	0.8	0.46	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
22	0.8	0.46	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
23	0.7	0.15	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
24	0,7	0,15	0,8	0,36	0,8	0,36	0,8	0,36	.....	.....
25	0.8	0.46	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
26	0.9	0.90	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
27	0.9	0.90	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
28	0.9	0.90	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
29	0.8	0.46	0.8	0.36	0.6	0.36	0.8	0.36	.....	.....
30	0.8	0.46	0.8	0.36	0.8	0.36	0.8	0.36	.....	.....
31	0.8	0.46	0.8	0.36	.....	.....	0.8	0.36	.....	.....

MONTHLY Discharge of Middle Creek at Ross' Ranche, for 1909.

[Drainage area 168 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage. area.	Total. in acre-feet.
July (20-31)	0.90	0.15	0.52	.003	.001	12
August	0.36	0.36	0.36	.002	.003	22
September	0.36	0.36	0.36	.002	.002	21
October	0.36	0.36	0.36	.002	.003	22
November (1-14)	0.36	0.36	0.36	.002	.001	10
The period	.....	.....	.....	.....	.....	87

MISCELLANEOUS MEASUREMENT.

MISCELLANEOUS MEASUREMENT OF MIDDLE CREEK.

On October 30, 1909, a measurement was made on Sec. 22, Tp. 5, R. 30, west of the 3rd meridian; the estimated discharge was 0.19 sec.-ft.

BATTLE CREEK AT STIRLING'S RANCHE.

This station was established August 12, 1909, by F. H. Peters. It is located on Sec. 22, Tp. 3, R. 27, west of the 3rd meridian. The gauge was erected for temporary use only and a cross-section of the stream at this point was developed for future use.

The channel is straight for 150 feet above and 200 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of sand with hard clay banks.

The gauge is a temporary rod made of 2in. x 6in. lumebr, marked off into feet and tenths by scratches on the surface of the wood and driven into the bed of the stream close to the left bank.

Discharge measurements are made at or near the station by wading. High-water measurements are not attainable owing to the absence of any structure from which to obtain such measurements. However, it is proposed to erect a cable station and establish a permanent gauge at some point in this vicinity in the near future in order that measurements may be made at all stages of the stream.

DISCHARGE measurements of Battle Creek at Stirling's Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec. ft.*
August 12	F. H. Peters	35.7	23.5	0.549	1.00	12.89
September 22	P. M. Sauder	20.0	11.6	0.695	0.77	8.05

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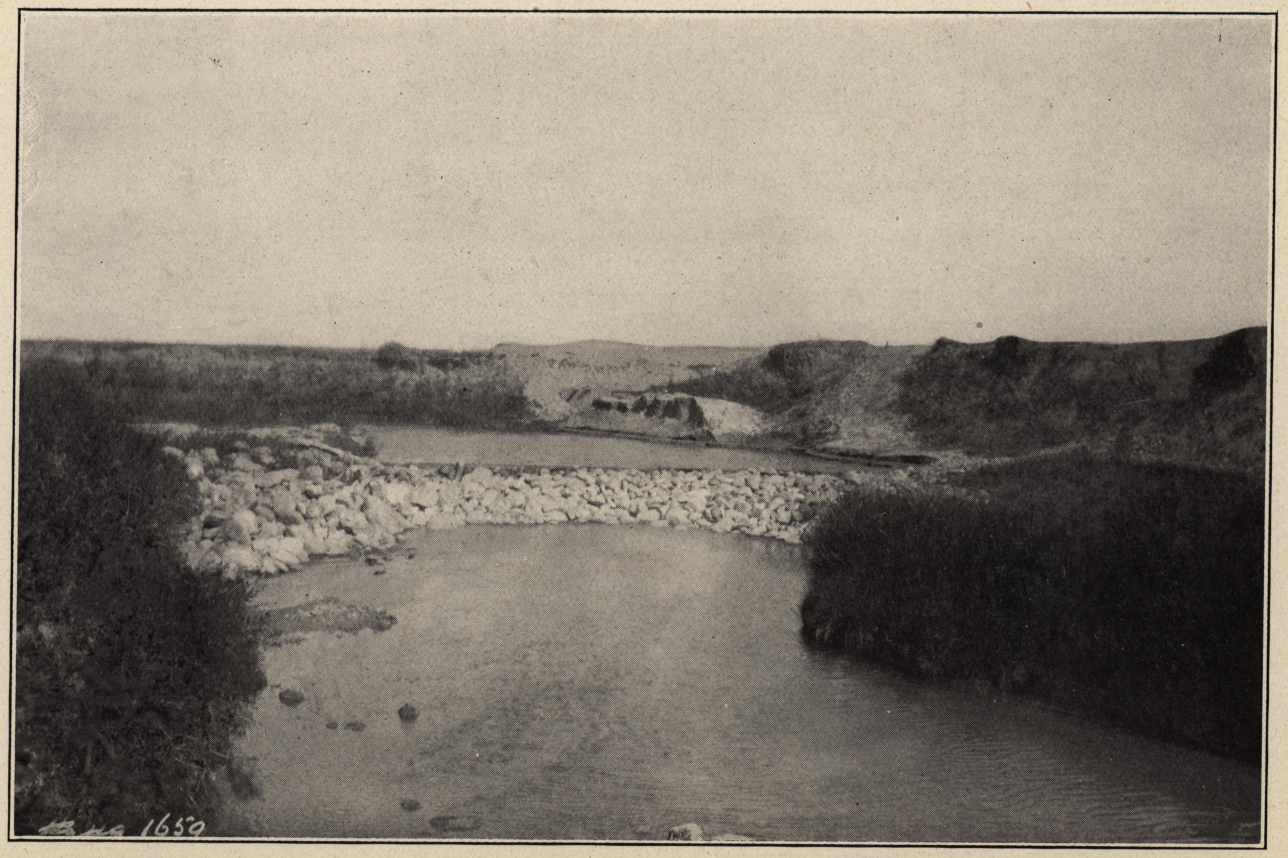

Dam in Battle Creek constructed by Nash and Sterling.

SESSIONA

DAILY

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DAILY Gauge Height and Discharge of Battle Creek at Stirling's Ranche, for 1909.

Day.	July.		August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7
2	.....	.....	.....	.....	0.8	8.7	0.8	8.7	0.7*	6.7
3	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.7	6.7
4	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.8	8.7
5	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.8	8.7
6	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.8	8.7
7	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.9	10.7
8	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.9	10.7
9	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.9	10.7
10	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.9	10.7
11	.....	.....	.....	.....	0.7	6.7	0.8	8.7	0.9	10.7
12	.....	.....	1.0	12.9	0.75	7.7	0.8	8.7	0.9	10.7
13	.....	.....	1.0	12.9	0.75	7.7	0.8	8.7	0.9	10.7
14	.....	.....	0.9	10.7	0.77	8.1	0.8	8.7	0.9	10.7
15	.....	.....	0.9	10.7	0.77	8.1	0.9	10.7	0.9	10.7
16	.....	.....	0.9	10.7	0.8	8.7	0.9	10.7	1.0	12.9
17	.....	.....	0.9	10.7	0.8	8.7	0.9	10.7	1.0	12.9
18	.....	.....	0.9	10.7	0.8	8.7	0.9	10.7	1.0	12.9
19	.....	.....	0.9	10.7	0.8	8.7	0.9	10.7	1.0	12.9
20	.....	.....	0.8	8.7	0.77	8.1	0.9	10.7	1.0	12.9
21	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
22	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
23	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
24	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
25	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
26	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
27	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
28	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
29	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
30	.....	.....	0.8	8.7	0.8	8.7	0.9	10.7	.....	.....
31	.....	.....	0.8	8.7	.....	.....	0.9	10.7	.....	.....

*J. A. Gaff using water in his ditch.

Battle Creek at Tenmile Police Detachment.

This station was established June 3, 1909, by F. T. Fletcher. It is located below the mouth of Tenmile Creek at the highway bridge on the surveyed trail from Maple Creek to Tenmile, and about 400 yards from the Tenmile Police Detachment. It is practically in the centre of Sec. 33, Tp. 5, R. 29, west of the 3rd meridian, about two miles south of Battle Creek post office and fifty-five miles south of Maple Creek. The bridge is a steel structure of the pony truss type, consisting of one 80 foot span, supported by two timber, rock-filled piers and having a twenty foot approach at each end of the bridge. There is only one channel at all ordinary stages of the stream, but owing to the presence of the two piers supporting the pony truss there are three channels in cases of extreme floods.

The channel is straight for 500 feet above and 300 feet below the station. Both banks are high and not liable to overflow except in extreme floods, when the water breaks over the right bank some distance above the station and flows around the gauge. The right bank is free of brush for some distance above and below the station; the left bank is sparsely covered with willows near the station. The bed of the stream is sandy and may shift somewhat in high stages of the stream. The current is very sluggish, and at very low stages vegetation appears in the bed of the stream at the station.

A standard chain gauge, which is read once each day by Constable W. A. Doak, of the R. N. W. M. Police, is located about the centre of the steel truss and is securely fastened to the guard-rail on the downstream side of the bridge. The length of the chain from the bottom of the weight to the marker is 19.10 feet. The gauge is referred to bench marks as follows: (1.) A bolt-head in the top of the left pier on the downstream side of the bridge, marked B. M. in black paint; elevation 13 97 feet above the datum of the gauge. (2.) The top of the iron pin in the road mound at the corner of the police fence, about 20 feet from the bridge on the left bank; elevation, 1,351 feet above the datum of the gauge.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inner face of the right abutment and marked O in black paint. Low-water measurements are made at a wading section about 400 yards upstream from the station.

Discharge Measurements of Battle Creek at Tenmile Police Detachment in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
November 4.....	F. T. Fletcher.....	31.0	20.0	1.29	.....	25.8
1909.						
May 28.....	H. R. Carscallen.....	34.5	84.3	1.03	.....	87
June 16.....	....do.....	31.5	57.4	0.58	2.725	33.6
July 1.....	....do.....	34.5	79.5	1.05	3.485	83.7
July 21.....	....do.....	21.0	18.2	1.20	2.69	21.9
August 9.....	....do.....	20.1	15.2	0.79	2.72	12.4
September 9.....	....do.....	21.5	18.0	0.28	2.35	5.1
September 29....	....do.....	21.0	15.4	0.62	2.44	9.6
November 4.....	....do.....	24.0	17.7	0.77	2.54	13.6

DAILY Gauge Height and Discharge of Battle Creek, at Tenmile Police Detachment, for 1909.

Day.	June.		July.		August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	3.5	85.1	2.7	22.05	2.4	8	2.4	8	2.5	11.8
2	.....	.....	3.5	85.1	2.7	22.05	2.35	6.5	2.4	8	2.5	11.8
3	2.8	38.6	3.4	75.2	2.7	22.05	2.35	6.5	2.4	8	2.5	11.8
4	2.8	38.6	3.1	49.6	2.7	22.05	2.35	6.5	2.4	8	2.5	11.8
5	2.7	32	3.1	49.6	2.7	22.05	2.35	6.5	2.5	11.8	2.5	11.8
6	2.7	32	3.0	42.1	2.7	22.05	2.4	8	2.5	11.8	2.5	11.8
7	2.7	32	3.0	42.1	2.7	22.05	2.4	8	2.5	11.8	2.5	11.8
8	2.8	38.6	3.0	42.1	2.7	22.05	2.4	8	2.5	11.8	2.5	11.8
9	2.9	45.8	2.9	35	2.7	22.05	2.4	8	2.5	11.8	2.5	11.8
10	3.0	53.6	2.9	35	2.6	16.45	2.4	8	2.5	11.8	2.5	11.8
11	3.0	53.6	2.95	38.5	2.6	16.45	2.4	8	2.5	11.8	2.5	11.8
12	3.0	53.6	3.0	42.1	2.6	16.45	2.4	8	2.5	11.8	2.5	11.8
13	2.9	45.8	3.0	42.1	2.5	11.8	2.4	8	2.5	11.8	2.5	11.8
14	2.9	45.8	3.0	42.1	2.5	11.8	2.4	8	2.5	11.8	.....	.....
15	3.0	53.6	2.9	35	2.4	8	2.4	8	2.5	11.8	.....	.....
16	3.0	53.6	2.9	35	2.4	8	2.4	8	2.5	11.8	.....	.....
17	3.0	53.6	2.9	35	2.4	8	2.4	8	2.5	11.8	.....	.....
18	3.5	102	2.8	28.3	2.4	8	2.4	8	2.5	11.8	.....	.....
19	3.5	102	2.8	28.3	2.4	8	2.4	8	2.5	11.8	.....	.....
20	6.2	.....	2.7	22.05	2.4	8	2.4	8	2.5	11.8	.....	.....
21	10.0	.....	2.7	22.05	2.4	8	2.4	8	2.5	11.8	.....	.....
22	6.7	.....	2.6	16.45	2.4	8	2.4	8	2.5	11.8	.....	.....
23	5.3	.....	2.6	16.45	2.4	8	2.4	8	2.5	11.8	.....	.....
24	4.8	.....	2.6	16.45	2.4	8	2.4	8	2.5	11.8	.....	.....
25	4.5	.....	2.6	16.45	2.4	8	2.4	8	2.5	11.8	.....	.....
26	4.0	143	2.6	16.45	2.3	5.2	2.4	8	2.5	11.8	.....	.....
27	3.9	131	2.6	16.45	2.3	5.2	2.4	8	2.5	1118	.....	.....
28	3.9	131	2.7	22.05	2.3	5.2	2.4	8	2.5	11.8	.....	.....
29	3.9	131	2.9	35	2.3	5.2	2.4	8	2.5	11.8	.....	.....
30	3.6	96	2.9	35	2.3	5.2	2.4	8	2.5	11.8	.....	.....
31	.....	.....	2.9	35	2.3	5.2	.....	.....	2.5	11.8	.....	.....

MONTHLY Discharge of Battle Creek, at Tenmile Police Detachment, for 1909.

[Drainage area, 220 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
June * {3–19, 26–30}	143	39	68.5	.311	.254	2,989
July	85	16	36.7	.167	.192	2,555
August	22	5	12.6	.057	.066	775
September	8	6	7.8	.035	.039	464
October	12	8	11.3	.051	.059	695
November	12	12	12.0	.054	.026	304
The period	.....	.....	.....	.....	.....	,7782

NOTE.—*The interval, June 20-25, inclusive, the flood period, is not included in results for June.

Tenmile Creek at Tenmile Police Detachment.

This station was established July 21, 1909, by H. R. Carscallen. It is located about 300 yards west of the Tenmile Police Detachment near the mouth of the stream. The station is very close to the south boundary of Sec. 4, Tp. 6, R. 29, west of the 3rd meridian, almost on the quartering line of the section and about two miles south of Battle Creek post office.

The channel is straight for 15 feet above and 20 feet below the station. Both banks are high, free from brush and not liable to overflow. The bed of the stream is composed of sand and coarse gravel. There is a small rapid above the station, but the current at the station is rather sluggish.

The gauge, which was read once each day during the season of 1909, by H. M. Covey, is a plain rod, graduated to feet and hundredths, nailed to an upright post sunk in the bed of the stream at the right bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) The top of the initial point stake driven close to the ground on the left bank and marked B. M. in red paint; elevation, 5.84 feet above the zero of the gauge. (2.) The head of a spike driven into the pointed top of a willow stump about 100 feet downstream from the station on the right bank, the stump blazed and marked B. M. in red paint; elevation, 6.15 feet above the zero of the gauge.

Discharge measurements are made at or near the gauge by wading, and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o.o with red paint.

Discharge Measurements of Tenmile Creek at Tenmile Police Detachment, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 28	H. R. Carscallen	3.5	1.95	0.405	.....	0.79
June 16	....do	4.0	1.32	0.311	.....	0.41
July 1	....do	4.5	1.71	0.480	.....	0.82
July 21	....do	1.25	*	0.20	0.82	0.35
August 9	....do	1.25	*	0.18	0.78	0.30
September 8	....do	1.25	*	0.13	0.82	0.19
September 29	....do	3.5	0.99	0.253	0.78	0.25
November 4	....do	1.25	*	0.26	0.79	0.26

* Weir measurements.

Daily Gauge Height and Discharge of Tenmile Creek, at Tenmile Police Detachment, for 1909.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
2	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
3	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
4	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
5	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
6	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
7	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
8	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
9	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
10	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
11	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
12	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
13	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
14	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
15	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
16	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
17	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
18	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
19	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
20	.....	.....	0.8	0.274	0.8	0.274	0.8	0.274
21	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
22	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
23	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
24	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
25	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
26	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
27	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
28	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
29	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
30	0.8	0.274	0.8	0.274	0.8	0.274	0.8	0.274
31	0.8	0.274	0.8	0.274	.....	.....	0.8	0.274

Monthly Discharge of Tenmile Creek, at Tenmile Police Detachment, for 1909.

[Drainage area, 26 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total. in acre-feet.
July (21–31)	0.274	0.274	0.274	.0105	.004	6
August	0.274	0.274	0.274	.0105	.012	17
September	0.274	0.274	0.274	.0105	.012	16
October	0.274	0.274	0.274	.0105	.012	17
The period	.....	.....	.....	.....	.....	56

Six Mile Coulee at Soderstrom's Ranche.

This station was established July 22, 1909, by H. R. Carscallen. It is located on Sec. 29, Tp. 7, R. 28, west of the 3rd meridian, two hundred yards west of the surveyed trail from Maple Creek to Tenmile and about thirty miles south of Maple Creek.

The channel is straight for 50 feet above and 20 feet below the station. Both banks are high and not liable to overflow. The right bank is sparsely covered with brush; the left bank is free of brush. The bed of the stream is composed of sand and very coarse gravel with clay at the banks. The current is moderate. A small amount of vegetation is present at the station.

The gauge, which is read once each day by J. M. Soderstrom, is a plain rod graduated to feet and hundredths, nailed to an upright post sunk in the bed of the creek at the right bank, and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) A nail-head driven into the top of a pointed willow stump on the right bank, about 150 feet up stream from the gauge, the stump blazed and marked B. M. in red paint; elevation, 7.77 feet above gauge zero. (2.) Nail-heads in the top of a log near the ground at the southeast corner of Mr. Soderstrom's north stable; elevation, 18.08 feet above gauge zero.

Discharge measurements are made at or near the station by wading, and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o.o in red paint.

Discharge Measurements of Six Mile Coulee, at Soderstrom's Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 2	H. R. Carscallen	10.7	17.4	0.987	.....	17.2
July 22	....do	5.0	5.1	0.754	1.47	3.8
September 9	....do	1.25	*	0.18	0.87	0.32
September 30	....do	4.7	1.8	0.186	0.83	0.33
November 5	....do	1.25	*	0.45	1.12	1.17

* Weir measurements.

DAILY Gauge Height and Discharge of Six Mile Coulee, at Soderstrom's Ranche, for 1909.

Day.	July.		August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharhe.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.9	10.95	1.0	0.7	0.7	0.1	1.2	1.6
2	.....	.....	1.8	8.65	1.0	0.7	0.6	0.05	1.2	1.6
3	.....	.....	1.6	5.4	1.0	0.7	0.5	0.02	1.1	1.07
4	.....	.....	1.7	6.90	1.0	0.7	0.5	0.02	1.1	1.07
5	.....	.....	1.8	8.65	1.0	0.7	0.6	0.05	1.1	1.07
6	.....	.....	1.8	8.65	1.0	0.7	0.6	0.05	1.1	1.07
7	.....	.....	1.7	6.90	1.0	0.7	0.7	0.1	1.1	1.07
8	.....	.....	1.8	8.65	0.9	0.4	0.9	0.4	1.1	1.07
9	.....	.....	1.7	6.9	0.9	0.4	1.0	0.7	.....	.....
10	.....	.....	1.6	5.4	0.9	0.4	1.0	0.7	.....	.....
11	.....	.....	1.6	5.4	1.0	0.7	1.0	0.7	.....	.....
12	.....	.....	1.6	5.4	1.0	0.7	1.0	0.7	.....	.....
13	.....	.....	1.5	4.2	1.0	0.7	1.0	0.7	.....	.....
14	.....	.....	1.5	4.2	1.1	1.07	1.1	1.07	.....	.....
15	.....	.....	1.4	3.1	1.1	1.07	1.1	1.07	.....	.....
16	.....	.....	1.3	2.3	1.0	0.7	1.1	1.07	.....	.....
17	.....	.....	1.3	2.3	1.0	0.7	1.1	1.07	.....	.....
18	.....	.....	1.3	2.3	1.0	0.7	1.2	1.6	.....	.....
19	.....	.....	1.2	1.6	1.0	0.7	1.2	1.6	.....	.....
20	.....	.....	1.2	1.6	1.0	0.7	1.2	1.6	.....	.....
21	.....	.....	1.1	1.07	1.0	0.7	1.2	1.6	.....	.....
22	1.5	4.2	1.1	1.07	1.0	0.7	1.1	1.07	.....	.....
23	1.4	3.1	1.1	1.07	1.0	0.7	1.1	1.07	.....	.....
24	1.4	3.1	1.1	1.07	1.0	0.7	1.2	1.6	.....	.....
25	1.4	3.1	1.1	1.07	1.0	0.7	1.2	1.6	.....	.....
26	1.7	6.9	1.1	1.07	1.0	0.7	1.2	1.6	.....	.....
27	1.9	10.95	1.0	0.7	0.9	0.4	1.2	1.6	.....	.....
28	2.5	34.5	1.0	0.7	0.9	0.4	1.1	1.07	.....	.....
29	2.1	16.7	1.0	0.7	0.9	0.4	1.2	1.6	.....	.....
30	2.0	13.75	1.0	0.7	0.8	0.2	1.2	1.6	.....	.....
31	1.9	10.95	1.0	0.7	.....	.....	1.3	2.30	.....	.....

MONTHLY Discharge of Six Mile Coulee, at Soderstrom's Ranche, for 1909.

[Drainage area, 21 square miles.]

	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
July (22–31)	34.5	3.13	10.7	.511	.190	213
August	11.0	0.70	3.85	.183	.211	237
September	1.1	0.20	0.65	.031	.035	39
October	2.3	0.02	0.97	.046	.053	60
November (1–8)	1.6	1.07	1.20	.057	.017	19
The period	.....	.....	.....	.....	.....	568

Frenchman River near East End, Sask.

This station was established July 31, 1908, by F. T. Fletcher. It is located at the Enright and Strong highway bridge on the northeast quarter of Sec. 31, Tp. 6, R. 21, west of the 3rd meridian. It is about eight miles south of East End post office and a mile above the East End Police Detachment. Three miles above the station are the dam and head-gates of Messrs. Enright and Strong's ditch, and hence the discharge of the stream at the station does not include that of the ditch and the latter must be added in order to obtain the total flow of the Frenchman River. The bridge is a single span, wooden structure set upon timber, rock-filled abutments.

The channel is straight for 400 feet above and 600 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of sand and gravel. The current is sluggish.

The gauge, a plain staff graduated to feet and hundredths, is attached vertically to the left abutment on its upstream side. It was read daily during the season of 1908 by J. Garrisiere, and during the season of 1909 by Charles Lock. The gauge is referred to bench marks as follows: (1.) Nail-head in the top of a long pile at the left bank and 10 feet above the bridge; elevation, 15.89 feet above the zero of the gauge. (2.) Nail-heads in the top of the stringer on the left abutment at the upstream side of the bridge, marked B. M. in red paint; elevation, 13.93 feet above the zero of the gauge.

Discharge measurements are made from the lower side of the bridge at high water stages, and at a wading section a short distance upstream at low water stages. The initial point for soundings is the inner face of the left abutment. The bridge is not quite at right angles to the direction of the current.

Discharge Measurements of Frenchman River, near East End, Sask, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 13	F. T. Fletcher	3.5	0.48	0.98	.....	0.47
July 31	....do	9.5	2.5	0.56	1.10	1.4
August 5	....do	.....	.....	.....	.....	Nil.
1909.						
April 19	F. T. Fletcher	49.5	34.8	2.67	.....	93.2*
April 30	....do	38.6	120.9	1.86	2.94	224.4
May 1	....do	38.6	104.7	1.53	2.52	159.8
May 19	H. R. Carscallen	38.0	163.8	1.92	3.465	311.2
June 8	....do	26.0	17.4	2.18	1.55	37.9
June 26	....do	38.0	115.9	2.35	3.34	266.6
July 13	....do	38.5	117.6	2.12	3.15	249.5
July 31	....do	35.0	29.4	2.50	1.93	73.5
August 23	....do	24.1	11.4	1.18	1.36	13.5
September 21	....do	20.0	10.2	1.67	1.42	17.0

* Ice conditions.

Gauging Station on Frenchman River, near East End, Sask.

DAILY Gauge Height and Discharge of Frenchman River, near East End, Sask., for 1909.

Day.	April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.5	158	1.7	52
2	.....	.....	2.3	128	1.6	41
3	.....	.....	3.7	350	1.3	13
4	.....	.....	6.8	921	1.4	22
5	.....	.....	6.4	841	1.5	32
6	.....	.....	4.5	487	1.4	22
7	.....	.....	3.2	265	1.5	32
8	.....	.....	2.7	187	1.5	32
9	.....	.....	2.3	128	1.6	42
10	.....	.....	2.6	172	1.7	53
11	.....	.....	2.4	143	1.7	54
12	.....	.....	3.1	249	1.6	42
13	.....	.....	2.9	217	1.6	42
14	.....	.....	2.7	187	1.5	32
15	.....	.....	2.5	157	1.4	23
16	.....	.....	2.2	114	1.2	8
17	.....	.....	2.4	142	1.3	14
18	.....	.....	3.7	350	1.4	22
19	.....	.....	3.5	316	1.6	41
20	.....	.....	2.3	128	2.9	211
21	6.7	904	2.8	202	8.7	1333
22	5.9	745	2.4	143	9.6	1523
23	5.1	595	2.5	158	4.7	496
24	3.7	352	3.4	300	4.1	392
25	4.3	455	3.1	250	3.5	291
26	5.4	650	2.5	158	3.3	259
27	5.9	745	2.1	102	3.0	212
28	4.6	507	2.0	88	2.6	153
29	3.8	369	1.9	76	2.9	200
30	2.9	219	1.5	30	2.9	201
31	.....	.....	1.8	64	.....	.....

DAILY Gauge Height and Discharge of Frenchman River, near East End, Sask., for 1909.—*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.6	157	1.8	57	1.4	16	1.4	16
2	2.5	144	1.7	45	1.4	16	1.4	16
3	2.3	116	1.6	35	1.4	16	1.4	16
4	2.2	104	1.6	35	1.4	16	1.4	16
5	2.7	177	1.6	35	1.4	16	1.4	16
6	3.2	256	1.6	35	1.4	16	1.4	16
7	3.3	273	1.6	35	1.4	16	1.4	16
8	2.8	194	1.6	35	1.4	16	1.4	16
9	2.5	150	1.6	35	1.4	16	1.4	16
10	2.2	108	1.6	35	1.4	16	1.4	16
11	4.0	393	1.6	35	1.4	16	1.4	16
12	3.3	274	1.6	35	1.4	16	1.4	16
13	3.2	258	1.6	35	1.4	16	*3.0	225
14	2.9	210	1.6	35	1.4	16	2.0	81
15	2.8	195	1.6	35	1.5	25	2.0	81
16	2.5	150	1.5	25	1.5	25	1.8	57
17	2.4	136	1.4	16	1.4	16	1.8	57
18	2.1	95	1.4	16	1.4	16	1.8	57
19	1.9	69	1.4	16	1.5	25	1.8	57
20	2.1	94	1.4	16	1.4	16	1.7	45
21	2.0	81	1.4	16	1.4	16	1.7	45
22	2.0	81	1.4	16	1.4	16	1.7	45
23	1.8	57	1.4	16	1.4	16	1.7	45
24	1.7	45	1.4	16	1.4	16	1.6	35
25	1.6	35	1.4	16	1.4	16	1.6	35
26	1.8	57	1.4	16	1.4	16	1.6	35
27	2.1	94	1.4	16	1.4	16	1.6	35
28	2.1	95	1.4	16	1.4	16	1.6	35
29	1.9	69	1.4	16	1.4	16	1.6	35
30	1.8	57	1.4	16	1.4	16	1.6	35
31	1.9	69	1.4	16	.....	.....	1.6	35

* Enright & Strong released the head on their dam.

MONTHLY Discharge of Frenchman River, near East End, Sask., for 1909.

[Drainage area, 635 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
June	1534	22.8	204.7	.322	.359	12182
July	399	37.5	143.1	.225	.259	8801
August	63	18.4	32.9	.052	.060	2021
September	27	16.6	21.1	.033	.037	1257
October	225	16.4	41.3	.065	.075	2537
The period	.....	.....	.....	.....	.....	26,798

Miscellaneous Measurement.

MISCELLANEOUS MEASUREMENTS OF FRENCHMAN RIVER.

On September 17, 1909, P. M. Sauder made a measurement of Frenchman River on Sec. 3, Tp. 1, R. 10, west of the 3rd meridian, the estimated discharge being 4.76 sec-ft.

The Enright and Strong Ditch near East End, Sask.

This station was established July 31, 1909, by F. T. Fletcher. It is located at the highway bridge on the Chinook trail, about one mile and a half west of the Enright and Strong ranche, and the same distance upstream from the bridge station on the Frenchman River. The station is about a mile and a half below the headgate of the ditch and two hundred yards above the diversion gates governing the flow of the two branches of the ditch. Hence measurements at the station are affected by changes of slope due to different positions of the headgate for the main ditch and the two diversion gates.

The ditch is straight for about 1000 feet upstream and 600 feet downstream, the south ditch continuing in the same straight course an additional distance of 600 feet before turning southward. The current is, in general, moderately fast, but is affected by the position of the governing gates as noted above.

The gauge is a plain staff, graduated to feet and hundredths, attached vertically to the downstream side of the centre bent of the bridge. Daily observations of gauge height were taken during the month of October, 1908, by J. Garrisiere, and during the season of 1909 by Charles Lock. The gauge is referred to bench marks as follows: (1.) Nail-heads on the upstream end of the first floor-plank at the right side of the bridge; elevation, 4.93 feet above the datum of the gauge. (2.) A square plug driven close to the ground 100 feet south of the bridge and in a line with the upstream hand-rail; elevation, 5.72 feet above the datum of the gauge.

Discharge measurements are made from the upper side of the bridge. The bridge divides the bridge into two channels by a central bent. The initial point for soundings is the inner face of the right abutment, marked O with white paint.

Discharge Measurements of Enright and Strong Ditch, near East End, Sask., in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 13	F. T. Fletcher	7.9	10.0	1.14	1.26	11.4
July 30	....do	10.5	6.0	0.41	0.95	2.5
July 31	....do	9.5	4.1	0.49	0.70	2.0
1909.						
May 19	H. R. Carscallen	15.0	15.6	0.93	1.63	14.6
June 8	....do	13.5	10.7	0.76	1.34	8.2
June 26	....do	13.7	5.1	0.49	1.61	2.5
July 13	....do	13.9	5.6	0.58	1.77	3.2
July 31	....do	17.0	21.6	0.31	2.04	6.7
August 23	....do	13.5	12.2	0.46	1.43	5.6
September 21	....do	8.1	2.3	0.59	0.99	1.4

DAILY Gauge Height and Discharge of Enright and Strong Ditch, near East End, Sask., for 1909.

Day.	May.		June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.4	9.35	1.4	1.75	2.0	6.1	1.6	8.25	0.8	0.6
2	.....	.....	1.5	11.5	0.9	3.1	2.1	7.7	1.6	8.25	0.8	0.6
3	.....	.....	1.4	9.35	0.7	2.0	2.1	7.7	1.5	6.6	0.8	0.6
4	.....	.....	1.4	9.35	0.9	3.1	2.0	6.1	1.5	6.6	0.8	0.6
5	.....	.....	1.4	9.35	0.8	2.5	2.1	7.7	1.6	8.25	0.8	0.6
6	.....	.....	1.4	9.35	1.1	4.8	2.0	6.1	1.6	8.25	0.7	0.4
7	.....	.....	1.4	9.35	2.1	7.7	1.9	4.65	1.5	6.6	0.8	0.6
8	.....	.....	1.4	9.35	2.1	7.7	2.0	6.1	1.6	8.25	1.0	1.4
9	1.7	16.4	1.3	7.5	2.0	6.1	2.1	7.7	1.6	8.25	1.0	1.4
10	1.3	7.5	1.4	9.35	2.0	6.1	2.2	9.45	1.5	6.6	1.0	1.4
11	1.5	11.5	1.4	9.35	2.0	6.1	2.0	6.1	1.5	6.6	1.0	1.4
12	1.1	4.8	1.3	7.5	1.8	3.55	2.0	6.1	1.5	6.6	1.0	1.4
13	1.3	7.5	1.3	7.5	1.8	3.55	2.0	6.1	1.5	6.6	0.4	0.1
14	1.5	11.5	1.3	7.5	2.0	6.1	1.9	4.65	1.5	6.6	0.4	0.1
15	1.5	11.5	1.5	11.5	1.8	3.55	1.9	4.65	1.1	2.1	0.4	0.1
16	1.5	11.5	1.7	16.4	1.6	2.45	1.8	3.55	1.1	2.1	0.4	0.1
17	1.7	16.4	1.5	11.5	1.7	2.85	1.9	4.65	1.2	3.0	0.4	0.1
18	1.6	13.85	1.4	9.35	1.7	2.85	1.9	4.65	1.2	3.0	0.0	0.0
19	1.6	13.85	1.5	11.5	1.9	4.65	1.8	3.55	1.1	2.1	0.0	0.0
20	1.4	9.35	1.5	11.5	1.6	2.45	1.7	2.85	1.1	2.1	0.0	0.0
21	1.5	11.5	2.5	15.2	1.8	3.55	1.6	2.45	1.0	1.4	0.0	0.0
22	1.3	7.5	2.3	11.3	1.6	2.45	1.6	2.45	1.0	1.4	0.0	0.0
23	1.5	11.5	2.1	7.7	1.8	3.55	1.4	5.20	1.0	1.4	0.0	0.0
24	1.6	13.85	1.9	4.65	1.9	4.65	1.6	8.25	1.0	1.4	0.0	0.0
25	1,7	16.4	1.8	3.55	1.6	2.45	1.4	5.20	1.0	1.4	0.0	0.0
26	1.5	11.5	1.6	2.45	2.1	7.7	1.5	6.6	0.8	0.6	0.0	0.0
27	1.6	13.85	1.5	2.1	2.2	9.45	1.6	8.25	0.8	0.6	0.0	0.0
28	1.6	13.85	1.6	2.45	2.0	6.1	1.6	8.25	0.8	0.6	0.0	0.0
29	1.5	11.5	1.7	2.85	2.1	7.7	1.5	6.6	0.8	0.6	0.0	0.0
30	1.7	16.4	1.5	2.1	2.1	7.7	1.9	14.9	0.8	0.6	0.0	0.0
31	1.7	16.4	.....	.....	2.0	6.1	1.8	12.4	.....	.....	0.0	0.0

MISCELLANEOUS MEASUREMENT.

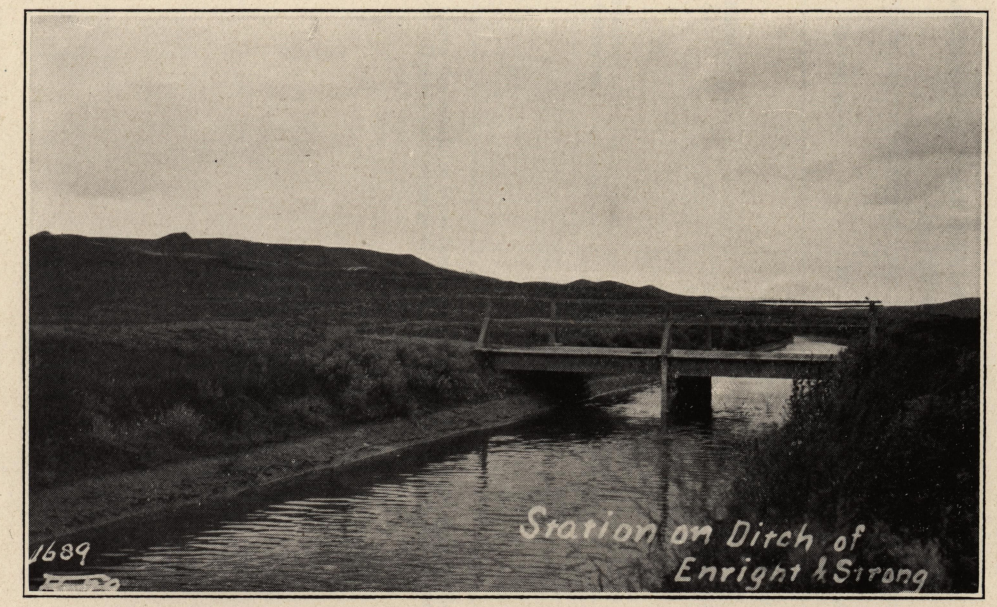
MISCELLANEOUS DISCHARGE MEASUREMENT OF WATSON'S COULEE, IN 1909.

On September 21, 1909, a weir measurement of this stream was made in Sec 7, Tp. 7, R. 21, west of the 3rd meridian, the estimated discharge being 0.08 sec.-ft.

NORTH FORK OF FRENCHMAN RIVER AT CROSS' RANCHE.

This station was established July 25, 1908, by F. T. Fletcher. It is located on Sec. 16, Tp. 7, R. 22, west of the 3rd meridian, about two and one-half miles from East End post office, and about forty-five miles southeast of Maple Creek, by trail.

The channel is straight for about 200 feet above and 600 feet below the station; the current is smooth and fairly swift. Both banks are high and not liable to overflow. The bed of the stream is sandy and may shift at high stages.



Gauging Station on Enright and Strong's Ditch, near East End, Sask.

Discharge measurements are made at or near the gauge by wading. The initial point for soundings is a square hardwood plug driven into the ground on the right bank of the stream and marked B. M. with white paint.

A plain staff, graduated to feet and hundredths, is placed vertically at the right bank about one mile downstream from the intake of Mr. Cross' irrigation ditch, and one hundred yards below his house. The gauge is read once each day by Mr. Cross. The gauge is referred to bench marks as follows: (1.) A bolt head in the ground-log at the southeast corner of Mr. Cross' house; elevation, 11.10 feet above gauge zero. (2.) A bolt-head in the initial point stake on the right bank; elevation, 5.45 feet above gauge zero.

DISCHARGE Measurements of North Fork of Frenchman River, at Cross' Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 21	F. T. Fletcher	13.0	4.7	0.81	.....	3.8
July 21	....do	12.5	4.9	1.00	.....	4.9
July 25	....do	12.0	4.4	0.91	.....	4.0
1909.						
April 19	F. T. Fletcher	19.5	17.6	1.09	.....	19.2*
May 19	H. R. Carscallen	12.8	12.2	1.57	0.89	19.2
June 26	....do	13.0	9.7	1.56	0.795	15.2
July 12	....do	12.5	14.2	2.05	1.025	29.1
August 2	....do	12.6	6.9	1.26	0.66	8.7
August 21	....do	13.0	6.1	1.16	0.66	7.1
September 20	....do	13.0	6.3	1.28	0.715	8.1

*Measurement made above the mouth of Rose Creek. Gauging made at same time on Rose Creek, estimated discharge 5.0 sec.-ft. Hence total discharge of the North Fork of the Frenchman River is 24.2 sec.-ft

DAILY Gauge Height and Discharge of North Fork of Frenchman River, at Cross' Ranch for 1908.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.5	2.1	0.6	5.6	0.6	5.6
2	0.5	2.1	0.6	5.6	0.6	5.6
3	0.5	2.1	0.6	5.6	0.6	5.6
4	0.5	2.1	0.6	5.6	0.6	5.6
5	0.5	2.1	0.6	5.6	0.7	9.7
6	0.5	2.1	0.6	5.6	0.7	9.7
7	0.5	2.1	0.6	5.6	0.7	9.7
8	0.6	5.6	0.6	5.6	0.7	9.7
9	0.6	5.6	0.6	5.6	0.7	9,7
10	0.5	2.1	0.6	5.6	0.7	9.7
11	0.5	2.1	0.6	5.6	0.7	9.7
12	0.6	5.6	0.6	5.6	0.7	9.7
13	0.6	5.6	0.6	5.6	1.7	9.7
14	0.6	5.6	0.6	5.6	0.7	9.7
15	0.6	5.6	0.6	5.6	0.7	9.7
16	0.6	5.6	0.6	5.6	0.7	9.7
17	0.6	5.6	0.6	5.6	0.7	9.7
18	0.6	5.6	0.6	5.6	0.7	9.7
19	0.6	5.6	0.6	5.6	0.7	9.7
20	0.6	5.6	0.6	5.6	.....	.....
21	0.6	5.6	0.6	5.6	.....	.....
22	0.6	5.6	0.6	5.6	.....	.....
23	0.6	5.6	0.6	5.6	.....	.....
24	0.6	5.6	0.6	5.6	.....	.....
25	0.6	5.6	0.6	5.6	.....	.....
26	0.6	5.6	0.6	5.6	.....	.....
27	0.6	5.6	0.6	5.6	.....	.....
28	0.6	5.6	0.6	5.6	.....	.....
29	0.6	5.6	0.6	5.6	.....	.....
30	0.6	5.6	0.6	5.6	.....	.....
31	0.6	5.6	.....	.....	.....	.....

DAILY Gauge Height and Discharge of North Fork of Frenchman River, at Cross' Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.8	14.9	0.9	20.1	0.7	9.7
2	0.9	20.1	0.8	14.9	0.7	9.7
3	1.3	41.3	0.8	14.9	0.7	9.7
4	1.7	62.6	0.8	14.9	0.7	9.7
5	1.7	62.6	0.8	14.9	1.4	46.6
6	1.3	41.3	0.8	14.9	1.1	30.7
7	1.0	25.4	0.8	14.9	0.8	14.9
8	1.2	36.0	0.9	20.1	0.8	14.9
9	0.9	20.1	0.9	20.1	0.8	14.9
10	0.9	20.1	0.9	20.1	0.8	14.9
11	1.0	25.4	0.9	20.1	1.1	30.7
12	1.0	25.4	0.8	14.9	1.0	25.4
13	0.9	20.1	0.8	14.9	0.9	20.1
14	0.9	20.1	0.8	14.9	0.8	14.9
15	0.9	20.1	0.7	9.7	0.7	9.7
16	0.9	20.1	0.7	9.7	0.7	9.7
17	1.3	41.3	0.7	9.7	0.7	9.7
18	1.2	36.0	0.7	9.7	0.9	20.1
19	0.9	20.1	0.7	9.7	0.9	20.1
20	0.9	20.1	1.4	46.6	0.8	14.9
21	0.9	20.1	2.0	78.8	0.7	9.7
22	0.8	14.9	1.0	25.4	0.7	9.7
23	0.9	20.1	0.9	20.1	0.7	9.7
24	0.9	20.1	0.8	14.9	0.7	9.7
25	0.9	20.1	0.8	14.9	0.7	9.7
26	0.9	20.1	0.8	14.9	0.7	9.7
27	0.9	20.1	0.8	14.9	0.9	20.1
28	0.9	20.1	0.8	14.9	0.9	20.1
29	0.9	20.1	0.8	14.9	0.8	14.9
30	0.9	20.1	0.8	14.9	0.75	12.3
31	0.9	20.1	.....	.....	0.7	9.7

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DAILY Gauge Height and Discharge of North Fork of Frenchman River, at Cross' Ranch for 1908.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.5	2.1	0.6	5.6	0.6	5.6
2	0.5	2.1	0.6	5.6	0.6	5.6
3	0.5	2.1	0.6	5.6	0.6	5.6
4	0.5	2.1	0.6	5.6	0.6	5.6
5	0.5	2.1	0.6	5.6	0.7	9.7
6	0.5	2.1	0.6	5.6	0.7	9.7
7	0.5	2.1	0.6	5.6	0.7	9.7
8	0.6	5.6	0.6	5.6	0.7	9.7
9	0.6	5.6	0.6	5.6	0.7	9,7
10	0.5	2.1	0.6	5.6	0.7	9.7
11	0.5	2.1	0.6	5.6	0.7	9.7
12	0.6	5.6	0.6	5.6	0.7	9.7
13	0.6	5.6	0.6	5.6	1.7	9.7
14	0.6	5.6	0.6	5.6	0.7	9.7
15	0.6	5.6	0.6	5.6	0.7	9.7
16	0.6	5.6	0.6	5.6	0.7	9.7
17	0.6	5.6	0.6	5.6	0.7	9.7
18	0.6	5.6	0.6	5.6	0.7	9.7
19	0.6	5.6	0.6	5.6	0.7	9.7
20	0.6	5.6	0.6	5.6	.....	.....
21	0.6	5.6	0.6	5.6	.....	.....
22	0.6	5.6	0.6	5.6	.....	.....
23	0.6	5.6	0.6	5.6	.....	.....
24	0.6	5.6	0.6	5.6	.....	.....
25	0.6	5.6	0.6	5.6	.....	.....
26	0.6	5.6	0.6	5.6	.....	.....
27	0.6	5.6	0.6	5.6	.....	.....
28	0.6	5.6	0.6	5.6	.....	.....
29	0.6	5.6	0.6	5.6	.....	.....
30	0.6	5.6	0.6	5.6	.....	.....
31	0.6	5.6	.....	.....	.....	.....

DAILY Gauge Height and Discharge of North Fork of Frenchman River, at Cross' Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.8	14.9	0.9	20.1	0.7	9.7
2	0.9	20.1	0.8	14.9	0.7	9.7
3	1.3	41.3	0.8	14.9	0.7	9.7
4	1.7	62.6	0.8	14.9	0.7	9.7
5	1.7	62.6	0.8	14.9	1.4	46.6
6	1.3	41.3	0.8	14.9	1.1	30.7
7	1.0	25.4	0.8	14.9	0.8	14.9
8	1.2	36.0	0.9	20.1	0.8	14.9
9	0.9	20.1	0.9	20.1	0.8	14.9
10	0.9	20.1	0.9	20.1	0.8	14.9
11	1.0	25.4	0.9	20.1	1.1	30.7
12	1.0	25.4	0.8	14.9	1.0	25.4
13	0.9	20.1	0.8	14.9	0.9	20.1
14	0.9	20.1	0.8	14.9	0.8	14.9
15	0.9	20.1	0.7	9.7	0.7	9.7
16	0.9	20.1	0.7	9.7	0.7	9.7
17	1.3	41.3	0.7	9.7	0.7	9.7
18	1.2	36.0	0.7	9.7	0.9	20.1
19	0.9	20.1	0.7	9.7	0.9	20.1
20	0.9	20.1	1.4	46.6	0.8	14.9
21	0.9	20.1	2.0	78.8	0.7	9.7
22	0.8	14.9	1.0	25.4	0.7	9.7
23	0.9	20.1	0.9	20.1	0.7	9.7
24	0.9	20.1	0.8	14.9	0.7	9.7
25	0.9	20.1	0.8	14.9	0.7	9.7
26	0.9	20.1	0.8	14.9	0.7	9.7
27	0.9	20.1	0.8	14.9	0.9	20.1
28	0.9	20.1	0.8	14.9	0.9	20.1
29	0.9	20.1	0.8	14.9	0.8	14.9
30	0.9	20.1	0.8	14.9	0.75	12.3
31	0.9	20.1	.....	.....	0.7	9.7

DAILY Gauge Height and Discharge of North Fork of Frenchman River, at Cross' Ranche, for 1909—*Concluded.*

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.7	9.7	0.65	7.65	0.65	7.65
2	0.65	7.65	0.65	7.65	0.65	7.65
3	0.65	7.65	0.65	7.65	0.65	7.65
4	0.65	7.65	0.7	9.7	0.65	7.65
5	0.65	7.65	0.7	9.7	0.65	7.65
6	0.65	7.65	0.7	9.7	0.65	7.65
7	0.65	7.65	0.7	9.7	0.65	7.65
8	0.7	9.7	0.7	9.7	0.65	7.65
9	0.65	7.65	0.7	9.7	0.7	9.7
10	0.65	7.65	0.7	9.7	0.7	9.7
11	0.65	7.65	0.7	9.7	0.7	9.7
12	0.65	7.65	0.7	9.7	0.75	12.3
13	0.65	7.65	0.65	7.65	0.75	12.3
14	0.65	7.65	0.65	7.65	0.75	12.3
15	0.65	7.65	0.7	9.7	0.75	12.3
16	0.65	7.65	0.7	9.7	0.75	12.3
17	0.65	7.65	0.65	7.65	0.75	12.3
18	0.65	7.65	0.65	7.65	0.75	12.3
19	0.65	7.65	0.7	9.7	0.75	12.3
20	0.65	7.65	0.7	9.7	0.75	12.3
21	0.65	7.65	0.7	9.7	0.75	12.3
22	0.6	5.6	0.7	9.7	0.75	12.3
23	0.6	5.6	0.65	7.65	0.7	9.7
24	0.6	5.6	0.65	7.65	0.7	9.7
25	0.6	5.6	0.65	7.65	0.7	9.7
26	0.6	5.6	0.65	7.65	0.7	9.7
27	0.65	7.65	0.65	7.65	0.7	9.7
28	0.65	7.65	0.65	7.65	0.7	9.7
29	0.65	7.65	0.65	7.65	0.7	9.7
30	0.65	7.65	0.65	7.65	0.7	9.7
31	0.65	7.65	.....	.....	0.7	9.7

NOTE.—Discharges for all gauge heights over 1.05 feet computed.

MONTHLY Discharge of North Fork of Frenchman River, at Cross' Ranche, for 1908-9.

[Drainage area, 58 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
August	5.6	2.1	4.6	.079	.091	282
September	5.6	5.6	5.6	.097	.108	333
October (1–19)	9.7	5.6	8.8	.152	.107	333
The period	.....	.....	.....	.....	.....	948
1909						
May	63	14.9	26.1	.450	.519	1.605
June	79	9.7	18.6	.321	.358	1.107
July	47	9.7	15.7	.270	.311	965
August	10	5.6	7.5	.128	.148	458
September	10	7.6	8.7	.150	.167	515
October	12	7.6	10.1	.174	.201	621
The period	.....	.....	.....	.....	.....	5.271

MISCELLANEOUS MEASUREMENTS.

Miscellaneous Measurements of Rose Creek, at a point on Sec. 22, Tp. 7, R. 22, west of the 3rd meridian, near its mouth, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Discharge.
1909.		*Feet.*	*Sq.-ft.*	*Ft. per sec.*	*Sec.-ft.*
April 19	F. T. Fletcher	9.0	7.66	0.65	5.02
August 2	....do	1.25	*	0.12	0.17
September 20	H. R. Carscallen	1.25	*	0.35	0.03

*Weir measurements.

MISCELLANEOUS Measurements of Calf Creek, at a point on Sec. 5, Tp. 8, R. 22, west of the 3rd meridian, near its mouth, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Discharge.
1908.		*Feet.*	*Sq.-ft.*	*Ft. per sec.*	*Sec.-ft.*
July 17	F. T. Fletcher	5.2	1.38	1.54	2.130
1909.					
August 2	H. R. Carscallen	7.0	2.66	0.55	1.48
August 23	....do	7.0	2.46	0.63	1.56
September 20	....do	7.5	2.71	0.57	1.83

MISCELLANEOUS Discharge Measurements of Black Tail Creek, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
			N. W. ¼ of	*Feet.*	*Sq.-ft.*	Sec.-ft.
July 14	H. R. Carscallen		Sec. 30–6–23–3	1.25	*0.09	0.11
August 3	do		Sec. 31–6–23–3	1.25	*0.06	0.07
September 24	do		Sec. 30–6–23–3 near month.	2.6	0.61	0.17

*Weir measurements.

FAIRWELL CREEK AT BOLTON'S RANCHE.

This station was established June 10, 1909, by H. R. Carscallen. It is located about eleven miles southeast of Belanger P. O., at Myles C. Bolton's ranche, on Sec. 30, Tp. 6, R. 24, west of the 3rd meridian.

The channel is straight for 75 feet upstream, and curves slightly to the right for 50 feet downstream. Both banks are comparatively low and will overflow at high stages of the stream. The banks are covered with brush above and below the station. The bed of the stream is composed of sand and coarse gravel. The current is sluggish at the station, but swift a short distance below.

The gauge, which was read daily during the season of 1909, by Myles C. Bolton, is a rod graduated to feet and hundredths, attached vertically to a post sunk in the bed of the stream at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) The head of a spike driven into the pointed top of a willow stump about 50 feet southeast of the gauge, the stump blazed and marked B. M. with red paint; elevation, 6.25 feet above the datum of the gauge. (2.) The head of a spike surrounded by a circle of nail-heads in a notch cut in a large poplar tree 60 feet southeast of the gauge, the tree blazed and marked B. M. with red paint; elevation, 5.08 feet above the datum of the gauge.

Discharge measurements are made a short distance below the gauge by wading. Owing to the low banks high-water measurements are not obtainable. Beaver dams below the station have given some trouble during the season of 1909. The initial point for soundings is a square stake driven close to the ground at the left bank and marked I.P. 0·0. From reports of men living in this district it was learned that the creek was perfectly dry, during the latter part of the season of 1909, within a mile upstream of the gauge, although a continuous flow was obtained at the station during the entire season. This phenomenon is peculiar to many of the streams in the Cypress Hills district.

DISCHARGE Measurements of Fairwell Creek, at Bolton's Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq.-ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 6	F. T. Fletcher	10.0	2.97	0.72	.....	2.15
1909.						
May 21	H. R. Carscallen	27.0	33.1	1.54	.....	51.1
June 10	do	25.5	16.0	0.73	1.94	11.6
June 28	do	24.5	27.3	2.99	2.75	81.8
July 15	do	24.0	21.0	2.41	2.555	50.7
August 25	do	24.0	16.6	0.39	2.00	6.4
September 25	do	17.5	6.2	0.66	1.92	4.1

DAILY Gauge Height and Discharge of Fairwell Creek, at Bolton's Ranche, for 1909.

Day.	June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.*
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.34	25.95	2.12	11.1	1.95	4.9	1.90	3.8
2	.....	.....	2.35	26.8	2.11	10.6	1.95	4.9	1.90	3.8
3	.....	.....	2.35	26.8	2.10	10.1	1.96	5.2	1.89	3.6
4	.....	.....	2.35	26.8	2.07	8.85	1.95	4.9	1.89	3.6
5	.....	.....	2.35	26.8	2.06	8.4	1.95	4.9	1.89	3.6
6	.....	.....	2.94	116.0*	2.05	8.	1.95	4.9	1.89	3.6
7	.....	.....	2.60	57.2	2.04	7.7	1.95	4.9	1.89	3.6
8	.....	.....	2.50	43.2	2.03	7.35	1.95	4.9	1.89	3.6
9	.....	.....	2.50	43.2	2.02	7.05	1.95	4.9	1.89	3.6
10	1.94	11.6	2.50	43.2	2.02	7.05	1.95	4.9	1.88	3.45
11	1.93	11.05	3.95	364.0*	2.03	7.35	1.95	4.9	1.88	3.45
12	1.92	10.55	3.00	128.0*	2.03	7.35	1.94	4.7	1.88	3.45
13	1.90	9.60	2.75	81.8	2.03	7.35	1.94	4.7	1.88	3.45
14	1.94	11.6	2.65	64.9	2.04	7.7	1.94	4.7	1.88	3.45
15	1.94	11.6	2.55	50	2.04	7.7	1.94	4.7	1.88	3.45
16	1.94	11.6	2.50	43.2	2.04	7.7	1.94	4.7	1.87	3.25
17	1.93	11.05	2.21	16.15	2.04	7.7	1.94	4.7	1.87	3.25
18	1.93	11.05	2.25	18.8	2.04	7.7	1.93	4.45	1.87	3.25
19	1.94	11.6	2.23	17.5	2.02	7.05	1.93	4.45	1.87	3.25
20	4.15	471.0*	2.16	13.2	2.02	7.05	1.93	4.45	1.87	3.25
21	4.10	443.0*	2.14	12.1	2.01	6.7	1.93	4.45	1.87	3.25
22	3.13	285.0*	2.13	11.6	2.01	6.7	1.93	4.45	1.87	3.25
23	2.75	81.8	2.10	10.1	2.00	6.4	1.93	4.45	1.87	3.25
24	2.82	94.4*	2.07	8.85	2.00	6.4	1.92	4.25	1.88	3.45
25	2.75	81.8	2.04	7.70	2.00	6.4	1.92	4.25	1.88	3.45
26	2.51	44.55	2.05	8.00	1.99	6.1	1.91	4	1.88	3.45
27	2.50	43.2	2.07	8.85	1.99	6.1	1.91	4	1.88	3.45
28	2.75	81.8	2.13	11.6	1.98	5.8	1.91	4	1.88	3.45
29	2.55	50	2.31	23.35	1.96	5.2	1.90	3.8	1.88	3.45
30	2.40	31.7	2.19	14.9	1.95	4.9	1.90	3.8	1.88	3.45
31	.....	.....	2.14	12.1	1.95	4.9	.....	.....	1.88	3.45

*Discharges computed.

MONTHLY Discharge of Fairwell Creek, at Bolton's Ranche, for 1909.

[Drainage area 135 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
June, 10–30	471	9.6	86.6	.642	.501	3,609
July	364	7.7	44	.326	.376	2,703
August	11.1	4.9	7.3	.054	.062	449
September	5.2	3.8	4.57	.034	.038	272
October	3.8	3.25	3.45	.026	.030	212
The period	.....	.....	.....	.....	.....	7,245

Davis Creek at Bettington's Ranche.

This station was established May 24, 1909, by H. R. Carscallen. It is located on Sec. 29, Tp. 6, R. 25, west of the 3rd meridian, about five miles southeast of Belanger, P.Q. and about one-half mile from the mouth of the creek.

The channel is straight for 150 feet above and 200 feet below the station. The right bank is comparatively high and will not overflow except in cases of extreme flood; the left bank is low and will overflow at high-water stages of the stream. Both banks are covered with brush. The bed of the stream is composed of sand and coarse gravel and there may be a slight sub-surface flow at this point. The current is swift.

The gauge is a plain staff, graduated to feet and hundredths, attached vertically to a post sunk in the bed of the stream at the right bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) The head of a spike in the top of a pointed willow stump about 15 feet below the gauge on the right bank, the stump blazed and marked B. M. with red paint; elevation 5.05 feet above gauge zero. (2) The head of a spike surrounded by a circle of nail-heads in the top of a log projecting from the southeast corner of Mr. Bettington's house; elevation, 9.05 feet above gauge zero. The gauge is read once each day by J. H. G. Bettington.

Discharge measurements are made at or near the gauge by wading. Owing to the left bank being low, high-water measurements are not obtainable. During the latter part of the season of 1909, considerable annoyance was experienced on account of the construction by beavers of dams below the gauge. These dams raised the water above its normal level and considerably affected the observer's gauge height records.

Discharge Measurements of Davis Creek, at Bettington's Ranche in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
August 21	F. T. Fletcher	5.0	0.83	0.32	.....	0.28
1909.						
June 11	H. R. Carscallen	12.5	5.10	1.16	1.14	5.94
June 29	....do	16.0	14.6	1.90	1.525	27.9
July 15	....do	15.0	11.6	1.44	1.355	16.8
August 5	....do	14.0	7.28	0.25	1.045	1.81
August 26	....do	9.2	2.84	0.59	1.00	1.67
September 27	....do	7.6	1.77	0.26	0.91	0.46

Daily Gauge Height and Discharge of Davis Creek, at Bettington's Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.2	8.8	1.5	26.1
2	.....	.....	1.2	8.8	1.4	19.8
3	.....	.....	1.2	8.8	1.2	8.8
4	.....	.....	1.1	4.5	1.2	8.8
5	.....	.....	1.1	4.5	1.4	19.8
6	.....	.....	1.1	4.5	2.0	64.0*
7	.....	.....	1.1	4.5	1.8	47.8*
8	.....	.....	1.1	4.5	1.4	19.8
9	.....	.....	1.2	8.8	1.3	14.1
10	.....	.....	1.1	4.5	1.3	14.1
11	.....	.....	1.1	4.5	1.6	32.8*
12	.....	.....	1.1	4.5	1.6	32.8*
13	.....	.....	1.1	4.5	2.0	64.0*
14	.....	.....	1.1	4.5	1.6	32.8*
15	.....	.....	1.1	4.5	1.4	19.8
16	.....	.....	1.1	4.5	1.4	19.8
17	.....	.....	1.2	8.8	1.3	14.1
18	.....	.....	1.3	14.1	1.5	26.1
19	.....	.....	1.3	14.1	1.4	19.8
20	.....	.....	5.3	.....†	1.3	14.1
21	.....	.....	6.0	.....†	1.3	14.1
22	.....	.....	2.2	.....†	1.2	8.8
23	2.8†	.....	1.7	40.1*	1.2	8.8
24	1.9	55.8*	1.6	32.8*	1.1	4.5
25	1.5	26.1	1.6	32.8*	1.1	4.5
26	1.4	19.8	1.6	32.8*	1.1	4.5
27	1.3	14.1	1.6	32.8*	1.1	4.5
28	1.3	14.1	1.7	40.1*	1.2	8.8
29	1.3	14.1	1.6	32.8*	1.3	14.1
30	1.2	8.8	1.55	29.4	1.1	4.5
31	1.2	8.8	.....	.....	1.1	4.5

Daily Gauge Height and Discharge of Davis Creek, at Bettington's Ranche, for 1909.—*Con.*

Day.	August.		September.		October.		November.	
	Gauge height.	Dis. charge.	Gauge height.	Dis-charge.	Gauge. height.	Dis. charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Eeet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	1.1	4.5	1.0	1.65	0.9	0.4	1.0	1.65
2	1.1	4.5	1.0	1.65	0.9	0.4	1.0	1.65
3	1.1	4.5	1.0	1.65	0.9	0.4	1.0	1.65
4	1.1	4.5	1.0	1.65	0.9	0.4	.....	.....
5	1.0	1.65	1.0	1.65	0.9	0.4		
6	1.0	1.65	1.0	1.65	0.9	0.4		
7	1.0	1.65	1.0	1.65	0.9	0.4		
8	1.0	1.65	1.0	1.65	0.9	0.4		
9	1.0	1.65	1.0	1.65	0.9	0.4		
10	1.0	1.65	1.0	1.65	0.9	0.4		
11	1.0	1.65	1.0	1.65	0.9	0.4		
12	1.0	1.65	1.0	1.65	0.9	0.4		
13	1.0	1.65	1.0	1.65	0.9	0.4		
14	1.0	1.65	1.0	1.65	0.9	0.4		
15	1.0	1.65	1.0	1.65	0.9	0.4		
16	1.0	1.65	1.0	1.65	0.9	0.4		
17	1.0	1.65	1.0	1.65	0.9	0.4		
18	1.0	1.65	1.0	1.65	0.9	0.4		
19	1.0	1.65	1.0	1.65	0.9	0.4		
20	1.0	1.65	1.0	1.65	0.9	0.4		
21	1.0	1.65	0.9	0.4	0.9	0.4		
22	1.0	1.65	0.9	0.4	0.9	0.4		
23	1.0	1.65	0.9	0.4	0.9	0.4		
24	1.0	1.65	0.9	0.4	0.9	0.4		
25	1.0	1.65	0.9	0.4	0.9	0.4		
26	1.0	1.65	0.9	0.4	0.9	0.4		
27	1.0	1.65	0.9	0.4	1.0	1.65		
28	1.0	1.65	0.9	0.4	1.0	1.65		
29	1.0	1.65	0.9	0.4	1.0	1.65		
30	1.0	1.65	0.9	0.4	1.0	1.65		
31	1.0	1.65	.....	.....	1.0	1.65		

*Discharges computed. †Data for computation of discharges insufficient.

MONTHLY Discharge of Davis Creek, at Bettington's Ranche, for 1909.

[Drainage area, 42 square miles.]

Month.	Dicsharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per spuare mile.	Depth in inches on drainage area.	Total in acre-feet.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
May (24-31)	55.8	8.8	20.2	.481	.143	321
June (1-19, 23-30)	40.1	4.5	14.8	.353	.354	793
July	64	4.5	19.4	.461	.531	1192
August	4.5	1.65	2.02	.048	.055	124
September	1.65	0.4	1.23	.029	.032	73
October	1.65	0.4	0.60	.014	.016	37
November (1-3)	1.65	1.65	1.65	.039	.004	10
The period						2550

NOTE.—June 20, 21 and 22, flood period, not included.

BELANGER CREEK AT GARRISON'S RANCHE, NEAR BELANGER P.O.

This station was established June 12, 1909, by H. R. Carscallen. It is located on Sec. 18, Tp. 7, R. 25, west of the 3rd meridian, one hundred and fifty yards west of Garrison's Ranche Belanger, P.O., and about twenty-seven miles south of Maple Creek.

The channel is straight for 100 feet above and 125 feet below the station. Both banks are comparatively high but will overflow in cases of extreme flood. The ground on the left bank is very rough and broken. Both banks are covered with low underbrush at the station and with large willow brush above and below. The bed of the stream is composed of sand and coarse gravel. The current is moderate at low stages.

The gauge, which is read daily by G. C. Garrison, is a plain staff, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the creek at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) The head of a spike surrounded by a circle of nail heads in the top of the initial point stake on the left bank, marked B. M. with red paint; elevation, 5.24 feet above the zero of the gauge. (2) The head of a spike driven into the top of a pointed willow stump about 40 feet northeast of the gauge on the left bank, the stump blazed and marked B. M. in red paint; elevation, 7.27 feet above the zero of the gauge.

Discharge measurements are made at the station by wading. No flood measurements are obtainable owing to the banks overflowing at extreme flood stages. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o.o.

DISCHARGE Measurements of Belanger Creek at Garrison's ranche in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 12	H. R. Carscallen	18.0	13.9	0.64	1.55	8.86
June 30	....do	19.5	25.0	1.54	2.11	38.5
July 17	....do	18.2	17.2	0.87	1.74	14.9
August 6	....do	18.5	15.9	0.61	1.62	9.69
August 26	....do	18.5	14.2	0.45	1.515	6.44
September 25	....do	18.5	12.7	0.37	1.445	4.72

DAILY Gauge Height and Discharge of Belanger Creek, at Garrison's Ranche, for 1909.

Day.	June.		July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.2	45.4	1.4	4.	1.4	4.	1.4	4
2	.....	.....	2.2	45.4	1.4	4.	1.4	4.	1.4	4
3	.....	.....	2.2	45.4	1.4	4.	1.4	4.	1.4	4
4	.....	.....	2.1	38.	1.6	9.	1.4	4.	1.4	4
5	.....	.....	2.1	38.	1.6	9.	1.4	4.	1.4	4
6	.....	.....	2.1	38.	1.6	9.	1.4	4.	1.4	4
7	.....	.....	2.0	30.8	1.6	9.	1.4	4.	1.4	4
8	.....	.....	2.0	30.8	1.6	9.	1.4	4.	1.4	4
9	.....	.....	2.3	53.2	1.55	7.5	1.4	4.	1.4	4
10	.....	.....	2.1	38.	1.55	7.5	1.4	4.	1.4	4
11	.....	.....	2.1	38.	1.55	7.5	1.4	4.	1.4	4
12	1.6	9.	2.1	38.	1.5	6.	1.4	4.	1.4	4
13	1.55	7.5	2.1	38.	1.5	6.	1.4	4.	1.4	4
14	1.5	6.	1.9	24	1.5	6.	1.4	4.	1.4	4
15	1.5	6.	1.8	18.	1.5	6.	1.4	4.	1.4	4
16	1.5	6.	1.8	18.	1.5	6.	1.4	4.	1.4	4
17	1.6	9,	1.7	13.	1.5	6.	1.4	4.	1.4	4
18	2.0	30.8	1.7	13.	1.5	6.	1.4	4.	1.4	4
19	2.4	61.9*	1.7	13.	1.5	6.	1.4	4.	1.4	4
20	4.1	296. *	1.6	9.	1.5	6.	1.4	4.	1.4	4
21	6.1	.....†	1.6	9.	1.5	6.	1.4	4.	1.4	4
22	2.6	82.5*	1.6	9.	1.5	6.	1.45	5.	1.45	5
23	2.3	53.2	1.5	6.	1.5	6.	1.45	5.	1.45	5
24	2.1	38.	1.5	6.	1.5	6.	1.45	5.	1.5	6
25	2.2	45.4	1.5	6.	1.5	6.	1.45	5.	1.5	6
26	2.1	38.	1.4	4.	1.5	6.	1.45	5.	1.5	6
27	2.1	38.	1.4	4.	1.5	6.	1.45	5.	1.5	6
28	2.1	38.	1.4	4.	1.5	6.	1.45	5.	1.5	6
29	2.1	38.	1.4	4.	1.5	6.	1.4	4.	1.5	6
30	2,1	38.	1.4	4.	1.4	4.	1.4	4.	1.5	6
31	.....	.....	1.4	4.	1.4	4.	.....	.....	1.5	6

*Discharges computed. †Data insufficient to compute discharge.

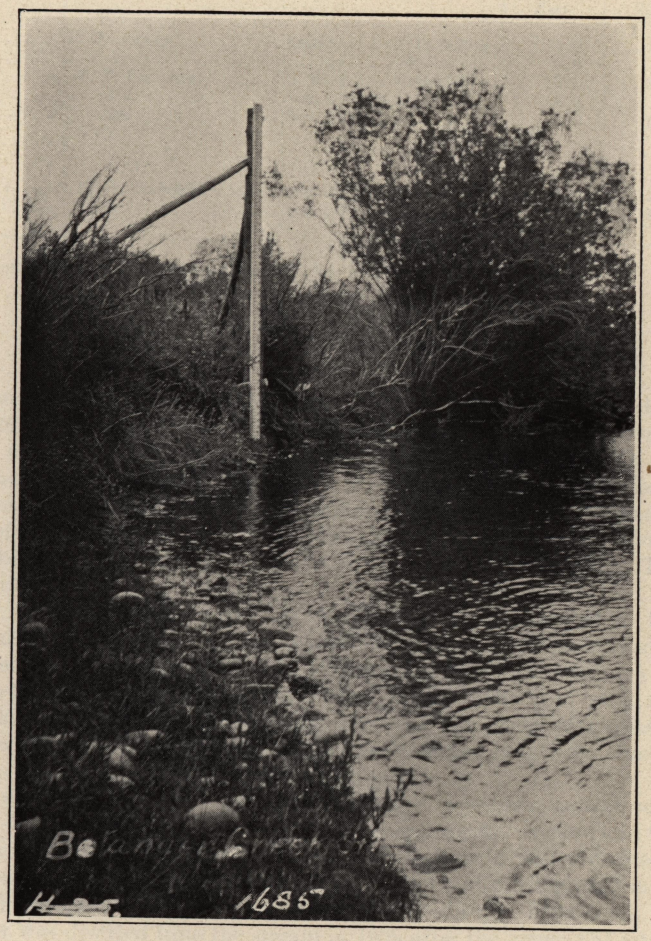
MONTHLY Discharge of Belanger Creek, at Garrison's Ranche, for 1909.

[Drainage area, 47 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
June....(12-20, 22-30)	296	6	46.7	.994	.665	1669
July	53.2	4	22.1	.470	.542	1358
August	9	4	6.3	.134	.154	387
September	5	4	4.2	.090	.100	252
October	6	4	4.6	.097	.112	282
The period	.....	.....	.....	.....	.....	3948

NOTE.—June 21, flood interval, not included.

PLATE NO. 18.



Gauge on Bélanger's Creek at Garrison's Ranche.

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Miscellaneous Measurements.

Miscellaneous Measurements of Belanger Creek in 1908–9.

Date.	Hydrographer.	Locality.	Width.	Area of Section.	Discharge.
1908.			*Feet.*	*Sq. ft.*	*Sec.-ft.*
June 10	R. J. Burley	Centre of Sec. 12-8-26-3	4.0	1.91	1.84
June 10	....do	....do.....do	3.0	.....*	1.81
August 17	F. T. Fletcher	S. W. ¼ Sec. 30-6-25-3	10.5	2.61	2.75
August 20	....do	Sec. 21-8-26-3	3.0	.....*	0.61
August 28	....do	Sec. 14-8-26-3	3.0	1.35	0.97
1909.					
May 25	H. R. Carscallen	Sec. 30-6-25-3	9.0	16.7	24.4
May 26	....do	Sec. 7-7-25-3 †	12.5	12.2	10.7

*Weir measurements. †Measurements made below mouth of Lone Pine Creek.

Lone Pine Creek at Hewitt's Ranche.

This station was established July 17, 1909, by H. R. Carscallen. It is located on Sec. 27, Tp. 7, R. 26, west of the 3rd meridian, about two miles west of the surveyed trail from Belanger, P.O. to Maple Creek and about four miles west of Belanger, P.O.

The channel is straight for 35 feet above and 45 feet below the station. The right bank is high and not liable to overflow; the left bank is comparatively low and will overflow at high stages of the stream. The surface of the ground on the left bank is very rough and broken. The bed of the stream is composed of sand and coarse gravel. The current is smooth and swift.

The gauge, which is read daily by S. W. Hewitt, is a rod, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the stream at the right bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) A spike-head in the top of the final point stake driven close to the ground on the right bank, marked B. M. in red paint; elevation, 5.63 feet above gauge zero. (2) The head of a spike in the top of a pointed willow stump on the left bank, 97 feet north of the gauge, the stump blazed and marked B. M.; elevation, 4.59 feet above gauge zero.

Discharge measurements are made near the gauge by wading and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. 0·0. The station is situated below ditches constructed by A. P. McDonald and S. W. Hewitt and in the case of water being used in these ditches the records at the gauge would not give the complete discharge of the creek. So far as is known, no water was diverted from the stream in 1909 after the gauge was established.

DISCHARGE Measurements of Lone Pine Creek at Hewitt's ranche in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1908.						
August 17	F. T. Fletcher	3.0	*	0.15*	.....	0.61
August 17	....do	4.0	1.12	0.56	.....	0.63
1909.						
July 17	H. R. Carscallen	4.3	2.99	0.76	1.70	2.26
August 6	....do	4.0	1.68	0.70	1.39	1.18
August 26	....do	1.25	*	20.9*	1.24	0.63
September 28	....do	3.4	1.34	0.60	1.285	0.81

*Weir measurements.

DAILY Gauge Height and Discharge of Lone Pine Creek, at Hewitt's Ranche, for 1909.

Day.	July.		August.		September.		October.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.45	1.33	1.25	0.72	1.25	0.72
2	.....	.....	1.45	1.33	1.25	0.72	1.25	0.72
3	.....	.....	1.4	1.16	1.25	0.72	1.25	0.72
4	.....	.....	1.4	1.16	1.25	0.72	1.3	0.85
5	.....	.....	1.4	1.16	1.25	0.72	1.3	0.85
6	.....	.....	1.35	1.	1.25	0.72	1.3	0.85
7	.....	.....	1.35	1.	1.25	0.72	1.35	1.
8	.....	.....	1.5	1.51	1.25	0.72	1.35	1.
9	.....	.....	1.4	1.16	1.25	0.72	1.35	1.
10	.....	.....	1.35	1.	1.25	0.72	1.35	1.
11	.....	.....	1.3	0.85	1.3	0.85	1.35	1.
12	.....	.....	1.3	0.85	1.25	0.72	1.35	1.
13	.....	.....	1.3	0.85	1.3	0.85	1.35	1.
14	.....	.....	1.3	0.85	1.3	0.85	1.35	1.
15	.....	.....	1.3	0.85	1.3	0.85	1.35	1.
16	.....	.....	1.25	0.72	1.3	0.85	1.40	1.16
17	1.7	2.26	1.25	0.72	1.25	0.72	1.35	1.
18	1.75	2.47	1.25	0.72	1.3	0.85	1.35	1.
19	1.7	2.26	1.25	0.72	1.35	1.	1.35	1.
20	1.55	1.69	1.25	0.72	1.3	0.85	1.35	1.
21	1.5	1.51	1.25	0.72	1.3	0.85	1.35	1.
22	1.55	1.69	1.25	0.72	1.3	0.85	1.35	1.
23	1.52	1.60	1.25	0.72	1.3	0.85	1.35	1.
24	1.52	1.60	1.25	0.72	1.3	0.85	1.35	1.
25	1.52	1.60	1.25	0.72	1.3	0.85	1.35	1.
26	1.55	1.69	1.25	0.72	1.3	0.85	1.35	1.
27	1.58	1.79	1.25	0.72	1.3	0.85	1.35	1.
28	1.65	2.07	1.25	0.72	1.25	0.72	1.35	1.
29	1.65	2.07	1.25	0.72	1.25	0.72	1.40	1.16
30	1.55	1.69	1.25	0.72	1.25	0.72	1.40	1.16
31	1.50	1.51	1.25	0.72	.....	.....	1.40	1.16

MONTHLY Discharge of Lone Pine Creek, at Hewitt's Ranche, for 1909.

[Drainage area, 4 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
July (17–31)	2.47	1.51	1.83	.458	.255	54
August	1.51	0.72	0.89	.220	.254	55
September	1.00	0.72	0.79	.200	.223	47
October	1.16	0.72	0.98	.245	272	60
The period	.....	.....	.....	.....	.....	216

MISCELLANEOUS MEASUREMENT.

MISCELANEOUS MEASUREMENT OF LONE PINE CREEK IN 1909.

On May 26, 1909, a measurement of Lone Pine Creek was made on Sec. 7, Tp. 7, R. 25, west of the 3rd meridian, near its mouth, the estimated discharge being 0.67 sec.-ft.

SUCKER CREEK AT WHITCOMB AND ZEIGLER'S RANCHE.

This station was established May 26, 1909 by H. R. Carscallen. It is located on the north boundary of Sec. 24, Tp. 6, R. 26, west of the 3rd meridian, about five miles south of Belanger Post Office and about thirty-two miles south of Maple Creek.

The channel is straight for 25 feet above and 45 feet below the station. The right bank is comparatively low and will overflow at high stages; the left bank is high and not liable to overflow. The right bank is sparsely covered with brush; the left bank is free from brush at the station. The bed of the stream is composed of sand and coarse gravel. The current is sluggish at the station but swift immediately below.

The gauge, which is read once each day by P. A. Zeigler, is a plain staff, graduated to feet and hundredths attached to a vertical post sunk in the bed of the stream at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) A circle of nail-heads in a log near the ground at the northeast corner of a stable; elevation, 12.27 feet above the zero of the gauge. (2) A spike-head in the top of the initial point stake on the left bank, marked B. M.; elevation, 5.30 feet above the zero of the gauge.

Discharge measurements are made at or near the gauge by wading and at very low stages a weir is used. High water measurements are not obtainable owing to the right bank overflowing at high stages of the stream. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o·o.

DISCHARGE Measurements of Sucker Creek at Whitcomb and Zeigler's Ranche in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 26	H. R. Carscallen	12.0	6.72	1.44	0.94	9.66
June 11	....do	11.0	7.19	0.46	0.66	3.33
June 29	....do	13.7	19.0	1.47	1.455	27.9
August 5	....do	7.5	1.81	0.65	0.54	1.17
August 26	....do	1.25	*	0.305	0.47	0.67
September 27	....do	7.1	2.29	0.85	0.57	1.94

*Weir measurement.

DAILY Gauge Height and Discharge of Sucker Creek, at Whitcomb and Ziegler's Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.7	4.	1.1	14.4
2	.....	.....	0.7	4.	1.0	11.35
3	.....	.....	0.6	2.3	0.9	8.6
4	.....	.....	0.6	2.3	0.9	8.6
5	.....	.....	0.6	2.3	2.3	80.9*
6	.....	.....	0.6	2.3	1.7	39.6*
7	.....	.....	0.7	4.	1.3	21.4
8	.....	.....	0.75	5.	1.1	14.4
9	.....	.....	0.8	6.1	1.1	14.4
10	.....	.....	0.65	3.1	1.0	11.35
						11.35
11	.....	.....	0.7	4.	1.0	
12	.....	.....	0.75	5.	1.1	14.4
13	.....	.....	0.65	3.1	1.05	12.9
14	.....	.....	0.64	2.95	1.0	11.35
15	.....	.....	0.63	2.8	0.9	8.6
16	.....	.....	0.65	3.1	0.8	6.1
17	.....	.....	1.1	14.4	0.8	6.1
18	.....	.....	0.85	7.3	0.75	5.
19	.....	.....	1.10	14.4	0.70	4.
20	.....	.....	3.8	.....†	0.65	3.1
21	.....	.....	3.7	.....†	0.65	3.1
22	.....	.....	1.8	45.1*	0.65	3.1
23	.....	.....	1.6	34.5*	0.65	3.1
24	.....	.....	1.4	25.4	0.65	3.1
25	1.0	11.35	1.5	29.8	0.65	3.1
26	0.9	8.6	1.15	16.1	0.8	6.1
27	0.8	6.1	1.05	12.8	0.7	4.
28	0.8	6.1	2.4	90.4*	0.9	8.6
29	0.7	4.	1.5	29.8	0.8	6.1
30	0.7	4.	1.3	21.5	0.7	4.
31	0.7	4.	.....	.....	0.65	3.1

DAILY Gauge Height and Discharge of Sucker Creek, at Whitcomb and Ziegler's Ranche, for 1909.—*Concluded.*

Date.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.65	3.1	0.5	1.	0.58	2.
2	0.65	3.1	0.5	1.	0.58	2.
3	0.62	2.6	0.6	2.3	0.6	2.3
4	0.58	2.	0.55	1.6	0.61	2.45
5	0.5	1.0	0.55	1.6	0.61	2.45
6	0.5	1.	0.5	1.	0.61	2.45
7	0.5	1.	0.5	1.	0.61	2.45
8	0.6	2.3	0.5	1.	0.61	2.45
9	0.55	1.6	0.5	1.	0.61	2.45
10	0.5	1.	0.47	0.75	0.62	2.6
11	0.5	1.	0.52	1.25	0.62	2.6
12	0.5	1.	0.55	1.6	0.62	2.6
13	0.55	1.6	0.61	2.45	0.62	2.6
14	0.5	1.	0.61	2.45	0.62	2.6
15	0.5	1.	0.6	2.3	0.62	2.6
16	0.45	0.55	0.55	1.6	0.62	2.6
17	0.43	0.5	0.55	1.6	0.62	2.6
18	0.42	0.45	0.7	4.	0.62	2.6
19	0.42	0.45	0.65	3.1	0.62	2.6
20	0.42	0.45	0.65	3.1	0.62	2.6
21	0.43	0.5	0.65	3.1	0.62	2.6
22	0.45	0.55	0.7	4.	0.62	2.6
23	0.45	0.55	0.7	4.	0.62	2.6
24	0.48	0.8	0.65	3.1	0.62	2.6
25	0.5	1.	0.6	2.3	0.62	2.6
26	0.5	1.	0.6	2.3	0.62	2.6
27	0.6	2.3	0.55	1.6	0.62	2.6
28	0.55	1.6	0.55	1.6	0.62	2.6
29	0.55	1.6	0.55	1.6	0.62	2.6
30	0.52	1.25	0.55	1.6	0.62	2.6
31	0.5	1.	.....	.....	0.62	2.6

*—Discharges computed. †—Data required to compute discharges insufficient.

MONTHLY Discharge of Sucker Creek at Whitcomb and Zeigler's Ranche for 1909.

[Drainage area, 36 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
May (25-31)	11.3	4.0	6.3	.175	.046	88
June (1-19—22-30)	90.4	2.3	14.2	.395	.411	789
July	80.9	3.1	11.5	.318	.367	705
August	3.1	0.45	1.25	.035	.040	77
September	4.	0.75	2.03	.056	.063	121
October	2.6	2.	2.52	.070	.081	155
The period	.....	.....	.....	.....	.....	1,935

NOTE.—June 20 and 21, flood interval, not included.

Oxarart Creek at Wylie's Ranche.

This station was established June 15, 1909, by H. R. Carscallen. It is located on Sec. 20, Tp. 6, R. 27, W. of the 3rd meridian, near the mouth of the creek and about thirty-five miles south of Maple Creek.

The channel upstream is straight for 10 feet and then divides into four small courses; the channel downstream is straight for 20 feet and then strikes an earth dam used in diverting water into Mr. Wylies' irrigation ditch. Here it makes a right-angled turn to the left, a small amount seeping through the dam and flowing down the natural course of the stream. The stream has a considerable fall and is subject to sudden and extreme floods necessitating the replacing of the dam below the station after every flood. This brings the records of gauge height observations under new sets of conditions and a different rating curve must be constructed for each change of conditions. Also low water records, only, are obtainable. The creek has a number of courses at low stages and the station although unsatisfactory is the only section to be found, within reach of an observer, where the total flow is contained in one channel during the low water period. The bed of the stream is composed of sand and coarse gravel. The current is sluggish at the station .

The gauge, which is read once each day by Mrs. J. Wylie, is a plain staff, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the stream at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) A spike-head in the top of the final point stake driven close to the ground on the right bank, marked B. M.; elevation, 4.71 feet above the zero of the gauge. (2) The top of three nails driven horizontally into a large willow tree, the tree blazed and marked B. M., on the strip of land upstream between the two courses of the stream furthest west and about 20 feet from the gauge; elevation, 4.45 feet above the zero of the gauge.

Discharge measurements are made a short distance above the station by wading. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I. P. o.o.

Discharge Measurements of Oxarart Creek at Wylie's Ranche in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
May 27	H. R. Carscallen	10.5	5.13	0.54	.....	2.77
June 15	....do	10.3	4.59	0.57	.....	2.64
June 30	....do	17.0	14.1	2.34	.....	33.2
July 19	....do	12.9	9.05	0.61	1.10	5.53
August 6	....do	15.0	7.28	0.50	1.015	3.64
September 7	....do	9.5	4.84	0.41	0.86	1.99
September 28	....do	6.7	2.52	0.57	0.81	1.45
November 23	....do	6.1	1.84	0.38	0.74	0.70

Daily Gauge Height and Discharge of Oxarart Creek, at Wylie's Ranche, for 1909.

Day.	July.		August.		September.		October.		November.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.0	3.7	0.95	3.	0.85	1.8	0.8	1.35
2	.....	.....	1.0	3.7	0.95	3.	0.9	2.3	0.8	1.35
3	.....	.....	1.0	3.7	1.	3.7	0.9	2.3	0.8	1.35
4	.....	.....	1.0	3.7	1.	3.7	0.9	2.3	0.8	1.35
5	.....	.....	1.0	3.7	0.95	3.	0.9	2.3	0.8	1.35
6	.....	.....	1.0	3.7	0.9	2.3	0.9	2.3	0.8	1.35
7	.....	.....	1.0	3.7	0.85	1.8	0.9	2.3	0.8	1.35
8	.....	.....	1.0	3.7	0.85	1.8	0.9	2.3	0.8	1.35
9	.....	.....	1.0	3.7	0.85	1.8	0.9	2.3	0.8	1.35
10	.....	.....	1.0	3.7	0.85	1.8	0.9	2.3	0.8	1.35
11	.....	.....	1.0	3.7	0.9	2.3	0.9	2.3	0.8	1.35
12	.....	.....	1.0	3.7	0.9	2.3	0.9	2.3	0.8	1.35
13	.....	.....	1.1	5.5	0.9	2.3	0.9	2.3	0.8	1.35
14	.....	.....	1.0	3.7	0.9	2.3	0.9	2.3	0.78	1.15
15	.....	.....	1.0	3.7	0.9	2.3	0.9	2.3	0.78	1.15
16	.....	.....	1.0	3.7	0.85	1.8	0.9	2.3	0.78	1.15
17	.....	.....	0.95	3.	0.85	1.8	0.9	2.3	.....	.....
18	.....	.....	0.9	2.3	0.85	1.8	0.85	1.85	.....	.....
19	1.1	5.5	0.9	2.3	0.85	1.8	0.85	1.8	.....	.....
20	1.1	5.5	0.95	3.	0.85	1.8	0.85	1.85	.....	.....
21	1.1	5.5	0.95	3.	0.85	1.8	0.85	1.8	.....	.....
22	1.1	5.5	1.0	3.7	0.85	1.8	0.85	1.85	.....	.....
23	1.1	5.5	1.0	3.7	0.85	1.8	0.8	1.35	.....	.....
24	1.1	5.5	1.0	3.7	0.85	1.8	0.8	1.35	.....	.....
25	1.1	5.5	1.0	3.7	0.85	1.8	0.8	1.35	.....	.....
26	1.0	3.7	1.0	3.7	0.85	1.8	0.8	1.35	.....	.....
27	1.0	3.7	1.0	3.7	0.8	1.35	0.8	1.35	.....	.....
28	1.0	3.7	0.95	3.	0.8	1.35	0.8	1.35	.....	.....
29	1.0	3.7	0.95	3.	0.8	1.35	0.8	1.35	.....	.....
30	1.0	3.7	0.95	3.	0.85	1.8	0.8	1.35	.....	.....
31	1.0	3.7	0.95	3.	.....	.....	0.8	1.35	.....	.....

Monthly Discharge of Oxarart Creek at Wylie's Ranche, for 1909.

[Drainage area, 73 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
July (19-31)	5.5	3.7	4.67	.064	.031	120
August	5.5	2.3	3.51	.048	.055	216
September	3.7	1.35	2.11	.029	.032	126
October	2.3	1.35	1.93	.026	.030	119
November (1-16)	1.35	1.15	1.31	.018	.011	42
The period	.....	.....	.....	.....	.....	623

Miscellaneous Measurement.

MISCELLANEOUS DISCHARGE MEASUREMENT OF WAR LODGE CREEK IN 1909.

On September 7, 1909, a weir measurement of War Lodge Creek was made on Sec. 14, Tp. 7, R. 27, west of the 3rd meridian, the estimated discharge being 0.137 sec.-ft.

Swiftcurrent Creek at Pollock's Ranche.

This station was established May 18, 1909, by H. R. Carscallen. It is located on Sec. 22, Tp. 7, R. 21, west of the 3rd meridian, about four miles southwest of South Fork Post Office.

The channel is straight for 50 feet above and 15 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of sand and gravel. The current is moderate at ordinary stages becoming sluggish at very low stages of the stream.

The gauge, which is read daily by D. Pollock, is a plain staff, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the stream at the right bank and firmly stayed to the bank. The gauge is referred to bench marks as follows: (1) The top of a hardwood plug driven close to the ground on the left bank beside the corner post of Mr. Pollock's fence, the post blazed and marked B. M.; elevation, 10.16 feet above the zero of the gauge. (2) A hardwood plug driven close to the ground beside a post in the line of fence running east from the corner post and about 100 feet from it, the post blazed and marked B. M.; elevation 9.24 feet above the zero of the gauge. (3) The top of the ground log at the southeast corner of Mr. Pollock's house, marked with three nail-heads; elevation, 21.28 feet above the zero of the gauge.

Discharge measurements are made at or near the gauge by wading and at very low stages a weir is used. Mr. Pollock diverts water from the creek into an irrigation ditch about one-half mile above the gauge and when he is using water in his ditch the gauge does not record the total flow of the creek.

Discharge Measurements of Swiftcurrent Creek at Pollock's Ranche in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 4	F. T. Fletcher	3.0	0.68	1.99	.....	1.36
July 4	....do	3.0	*	0.24	.....	1.21
1909.						
April 17	F. T. Fletcher	2.2	2.96	1.17	.....	3.47
May 18	H. R. Carscallen	4.2	2.06	1.39	1.03	2.86
June 5	....do	4.0	1.25	0.63	0.765	0.79
June 25	....do	3.8	1.89	0.54	0.85	1.03
July 10	....do	1.25	*	0.34	0.90	0.78
July 30	....do	4.5	1.85	0.80	1.005	1.49
August 20	....do	1.25	*	0.342	0.93	0.79
September 24	....do	4.4	1.70	0.43	0.85	0.74

*Weir measurements.

DAILY Gauge Height and Discharge of Swiftcurrent Creek, at Pollock's Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.8	1.	1.0	1.75
2	.....	.....	0.8	1.	1.0	1.65
3	.....	.....	0.8	1.	0.9	1.
4	.....	.....	0.8	1.	0.9	0.95
5	.....	.....	0.8	1.	2.0	21.
6	.....	.....	0.8	1.	2.0	21.
7	.....	.....	0.8	1.	1.9	18.
8	.....	.....	0.8	1.	1.9	18.
9	.....	.....	0.8	1.	1.0	1.3
10	.....	.....	0.8	1.	0.9	0.8
11	.....	.....	0.8	1.	0.9	0.8
12	.....	.....	0.8	1.	0.9	0.8
13	.....	.....	0.8	1.	0.9	0.8
14	.....	.....	0.8	1.	0.8	0.4
15	.....	.....	0.8	1.	0.8	0.4
16	.....	.....	0.7	0.55	0.8	0.4
17	.....	.....	0.7	0.55	0.8	0.4
18	1.04	3.07	0.7	0.55	0.8	0.4
19	1.01	2.68	0.8	1.	0.8	0.4
20	1.01	2.68	2.01	23.*	0.8	0.4
21	1.01	2.68	1.9	20.*	0.7	0.15
22	0.9	1.65	1.8	18.*	0.7	0.15
23	0.9	1.65	1.7	15.*	0.9	0.8
24	0.9	1.65	1.0	2.1	0.9	0.8
25	0.8	1.	0.9	1.3	0.9	0.8
26	0.8	1.	1.0	1.95	1.0	1.45
27	0.8	1.	1.0	1.9	1.0	1.45
28	0.8	1.	1.0	1.9	1.0	1.45
29	0.8	1.	1.0	1.85	1.0	1.45
30	0.8	1.	1.0	1.8	0.9	0.8
31	0.8	1.	.....	.....	0.9	0.8

DAILY Gauge Height and Discharge of Swiftcurrent Creek, at Pollock's Ranche, for 1909.—*Concluded.*

Date.	August.		September.		October.	
	Gauge. height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.9	0.8	0.75	0.25	0.75	0.25
2	0.9	0.8	0.75	0.25	0.75	0.25
3	0.9	0.8	0.75	0.25	0.75	0.25
4	0.9	0.8	0.75	0.25	0.75	0.25
5	0.9	0.8	0.75	0.25	0.75	0.25
6	0.9	0.8	0.7	0.15	0.75	0.25
7	0.9	0.8	0.75	0.25	0.75	0.25
8	1.0	1.45	0.75	0.25	0.75	0.25
9	1.0	1.45	0.7	0.15	0.8	0.4
10	0.9	0.8	0.7	0.15	0.8	0.4
11	0.9	0.8	0.7	0.15	0.8	0.4
12	0.9	0.8	0.75	0.25	0.8	0.4
13	0.9	0.8	0.75	0.25	0.8	0.4
14	0.9	0.8	0.85	0.6	0.8	0.4
15	0.9	0.8	0.85	0.6	0.8	0.4
16	0.9	0.8	0.75	0.25	0.8	0.4
17	0.9	0.8	0.75	0.25	0.8	0.4
18	0.9	0.8	0.8	0.4	0.8	0.4
19	0.9	0.8	0.8	0.4	0.8	0.4
20	0.9	0.8	0.85	0.6	0.8	0.4
21	0.9	0.8	0.85	0.6	0.8	0.4
22	0.75	0.25	0.8	0.4	0.8	0.4
23	0.75	0.25	0.8	0.4	0.85	0.6
24	0.75	0.25	0.8	0.4	0.9	0.8
25	0.8	0.4	0.75	0.25	0.9	0.8
26	0.85	0.6	0.75	0.25	0.9	0.8
27	0.75	0.25	0.75	0.25	0.9	0.8
28	0.75	0.25	0.75	0.25	0.9	0.8
29	0.75	0.25	0.75	0.25	0.9	0.8
30	0.75	0.25	0.75	0.25	0.9	0.8
31	0.75	0.25	.....	.....	0.9	0.8

*—Discharges computed.

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of D. Pollock's Ditch in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq.-ft.*	*Sec.-ft.*
May 18	H. R. Carscallen	About ¼ mile below intake.	2.2	1.00	2.00
June 5	do	do	3.5	1.55	1.23
June 25	do	do	4.0	2.33	2.67
July 10	do	do	3.5	1.91	1.88
July 30	do	do	.....	.....	0.00*
August 20	do	do	.....	.....	0.00*
September 24	do	do	2.8	1.39	0.62

*No water in ditch.

Jones Coulee at Read's Ranche.

This station was established September 23, 1909 by H. R. Carscallen. It is located on Section 5, Tp. 8, Range 20, West of the 3rd Meridian, about 300 yards from the surveyed trail to Gull Lake and about forty-two miles south of Gull Lake. It is about two miles and a half northeast of South Fork Post Office and near the mouth of the stream.

The channel is straight for 75 feet above and 50 feet below the station. Both banks are high and not liable to overflow. The banks are free from brush except for a little undergrowth near the station on the left bank. The bed of the stream is composed of soft clay with sand underneath. The current is very sluggish and the water is comparatively deep at the station, giving rise to a small amount of vegetation.

The gauge, which is read each day by W. F. Read, is a rod, graduated to feet and hundredths, attached vertically to a post sunk in the bed of the creek at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) A spike head in the top of the final point stake driven close to the ground on the right bank and marked B. M.; elevation, 8.25 feet above gauge zero. (2) The top of two spikes driven horizontally into the end of a log at the northwest corner of Mr. Reid's stable, the log marked B. M.; elevation, 11.46 feet above gauge zero.

Discharge measurements are made a short distance upstream from the gauge by wading and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I. P. o.o.

Discharge Measurements of Jones' Coulee at Read's Ranche in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge. height.	Discharge.
1908.		*Feet.*	*Sq.-ft.*	*Ft.per sec.*	*Feet.*	*Sec.-ft.*
July 8	F. T. Fletcher	3.0	*	0.188	.....	0.80
July 10	do	3.0	*	0.08	.....	0.24
1909.						
September 23	H. R. Carscallen	8.2	2.35	0.37	2.09	0.86

*Weir measurements taken on sec. 8–8–20–3, the section north of the one on which the station is located.

DAILY Gauge Height, in feet, of Jones Coulee, Read's Ranche, for 1909.

	Sept.	Oct.		Sept.	Oct.
1	.....	2.0	16	.....	2.2
2	.....	2.2	17	.....	2.25
3	.....	2.2	18	.....	2.2
4	.....	2.2	19	.....	2.15
5	.....	2.3	20	.....	2.3
6	.....	2.2	21	.....	2.2
7	.....	2.2	22	.....	2.3
8	.....	2.3	23	2.1	2.3
9	.....	2.3	24	2.1	2.3
10	.....	2.3	25	2.1	2.3
11	.....	2.3	26	2.2	2.2
12	.....	2.2	27	2.3	2.3
13	.....	2.3	28	2.2	2.3
14	.....	2.3	29	2.0	2.3
15	.....	2.3	30	2.3	2.3
			31	.....	2.3

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements of Swiftcurrent Creek in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq ft.*	*Sec.-ft.*
July 9	H. R. Carscallen	Sec. 18–10–19–3 just below forks.	36.5	41.3	47.7
July 9	do	Section 18–10–19–3 just above forks.	11.5	15.7	21.4
September 4	do	Swiftcurrent, Sask.	26.0	19.8	14.5
September 22	do	Section 18–10–19–3 just below forks.	26.5	14.6	13.2
September 22	do	Section 18–10–19–3 just above forks.	10.0	4.99	2.03

MISCELLANEOUS Discharge Measurements of McNicol Coulee on Sec. 21–7–21–3, in 1908–9.

Date.	Hydrographer.	Weir dimension.		Discharge.
		Breadth.	Head.	
		Feet.	*Feet.*	*Sec.-ft.*
1908.				
July 4	F. T. Fletcher	1.0	0.08	0.079
1909.				
September 21	H. R. Carscallen	1.25	0.75	0.085

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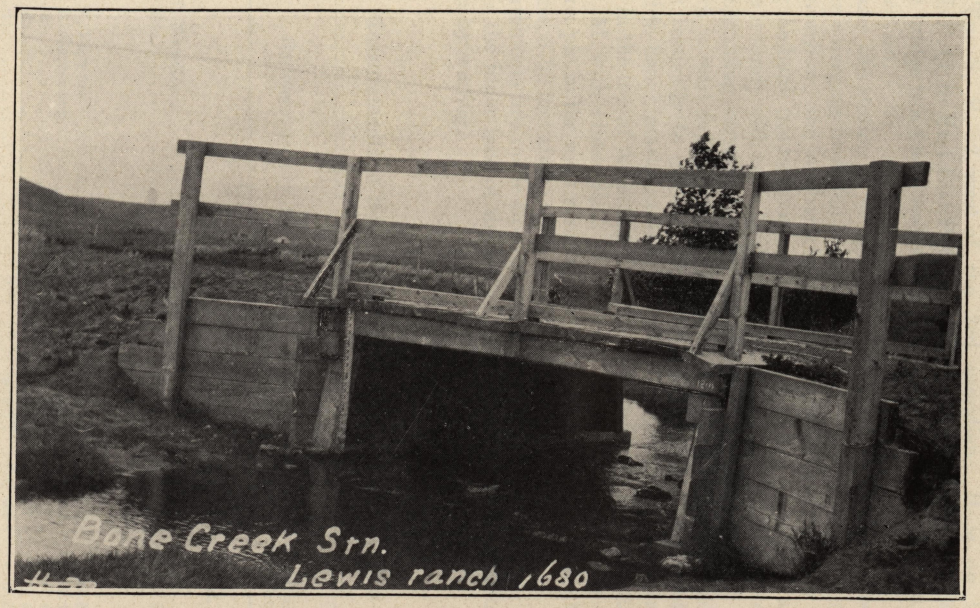


Gauging Station on Bone Creek, near Lewis' Ranche.

Miscellaneous Discharge Measurements of Chimney Coulee, in 1909.

On September 21, 1909, a weir measurement of this stream was made on Sec. 14, Tp. 7, R. 21, west of the 3rd meridian, the estimated discharge being 0.019 sec.-ft.

Bone Creek at Lewis' Ranche.

This station was established July 2, 1908 by F. T. Fletcher. It is located at the highway bridge on Sec. 34, Tp. 8, R. 22, west of the 3rd meridian. It is on the surveyed trail from Skull Creek P. O. to East End P. O. and about fifteen miles south of Skull Creek P. O., by trail. The bridge is a small wooden structure, built in the form of a culvert with a rectangular cross-section.

The channel above the station is straight for 50 feet; the channel below the station curves gradually after emerging from the downstream side of the bridge. The right bank is high and will not overflow; the left bank is comparatively low although no indication of the water overflowing the bank can be found. Both banks are free from brush at the station. The bed of the stream is sandy with some large stones scattered along the cross-section. The current is moderate becoming very swift below the station.

The gauge, which is read daily by C. L. Lewis, is a plain staff, graduated to feet and hundredths, attached vertically to the left abutment on the upstream side of the bridge. The gauge is referred to bench marks as follows: (1) The head of a spike surrounded by a circle of nail heads in the top of the stringer on the left abutment at the upstream side of the bridge, marked B. M. with white paint; elevation, 4.17 feet above the zero of the gauge. (2) The top of the iron pin in the road mound 754 feet north of the bridge on the left bank of the creek; elevations, 5.92 feet above the zero of the gauge.

Discharge measurements are made from the upstream side of the bridge. The initial point for soundings is the inner face of the left abutment. Low-water measurements are made near the station by wading.

Discharge Measurements of Bone Creek, at Lewis' Ranche, in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 27	F. T. Fletcher	3.0	*	0.285	.....	1.51
July 2	....do	4.7	1.81	0.83	0.39	1.51
1909.						
April 16	F. T. Fletcher	7.8	4.14	1.52	0.55	6.29
May 15	H. R. Carscallen	9.0	5.95	0.44	0.48	2.62
June 4	....do	5.0	1.82	1.17	0.415	2.13
June 25	....do	9.5	6.25	0.47	0.46	2.92
July 8	....do	9.0	5.57	0.49	0.39	2.72
July 30	....do	9.0	3.87	0.49	0.31	1.90
August 20	....do	8.0	2.21	0.50	0.28	1.10
September 18	....do	8.5	3.41	0.76	0.405	2.59

*Weir measurement.

DAILY Gauge Height and Discharge of Bone Creek at Lewis Ranche, for 1908.

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.35	1.8	0.32	1.6	0.4	2.3	0.35	1.8
2	0.35	1.8	0.33	1.65	0.35	1.8	0.35	1.8
3	0.35	1.8	0.32	1.6	0.35	1.8	0.38	2.1
4	0.32	1.65	0.33	1.65	0.4	2.3	0.37	2.
5	0.35	1.8	0.32	1.6	0.4	2.3	0.38	2.1
6	0.35	1.8	0.35	1.8	0.35	1.8	0.4	2.3
7	0.32	1.6	0.35	1.8	0.35	1.8	0.4	2.3
8	0.33	1.65	0.35	1.8	0.35	1.8	0.4	2.3
9	0.32	1.6	0.4	2.3	0.35	1.8	0.38	2.1
10	0.3	1.45	0.38	2.1	0.35	1.8	0.37	2.
11	0.3	1.45	0.37	2.	0.35	1.8	0.35	1.8
12	0.3	1.45	0.4	2.3	0.35	1.8	0.35	1.8
13	0.3	1.45	0.47	3.5	0.33	1.65	0.35	1.8
14	0.3	1.45	0.48	3.7	0.35	1.8	0.35	1.8
15	0.3	1.45	0.4	2.3	0.35	1.8	0.36	1.9
16	0.33	1.65	0.38	2.1	0.35	1.8	0.37	2.
17	0.4	2.3	0.37	2.	0.35	1.8	0.4	2.3
18	0.4	2.3	0.35	1.8	0.35	1.8	0.4	2.3
19	0.35	1.8	0.35	1.8	0.33	1.65	0.37	2.
20	0.32	1.6	0.35	1.8	0.3	1.45	0.5	4.1
21	0.33	1.65	0.35	1.8	0.3	1.45	0.7	9.4
22	0.32	1.6	0.35	1.8	0.3	1.45	0.8	12.2
23	0.33	1.65	0.35	1.8	0.3	1.45	0.9	15.4
24	0.32	1.6	0.35	1.8	0.35	1.8	2.0	56.
25	0.33	1.65	0.5	4.1	0.35	1.8	1.6	40.3
26	0.32	1.6	0.45	3.1	0.35	1.8	0.7	9.4
27	0.33	1.65	0.4	2.3	0.35	1.8	0.5	4.1
28	0.32	1.6	0.4	2.3	0.37	2.	0.45	3.1
29	0.33	1.65	0.4	2.3	0.38	2.1	0.45	3.1
30	0.32	1.6	0.4	2.3	0.37	2.	0.45	3.1
31	0.33	1.65	0.4	2.3	.....	.....	0.45	3.1

NOTE.—See foot note under gauge height and discharge table of Bone Creek for 1909.

DAILY Gauge Height and Discharge of Bone Creek at Lewis' Ranche, for 1909.

Day.	March.		April.		May.		June.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.4	2.3	0.5	4.1	0.5	4.1
2	.....	.....	0.45	3.1	0.5	4.1	0.5	4.1
3	.....	.....	0.5	4.1	0.8	12.25	0.5	4.1
4	.....	.....	0.5	4.1	0.7	9.4	0.45	3.1
5	.....	.....	0.5	4.1	0.6	6.7	0.45	3.1
6	.....	.....	0.45	3.1	0.6	6.7	0.5	4.1
7	.....	.....	0.5	4.1	0.6	6.7	0.5	4.1
8	.....	.....	0.5	4.1	0.5	4.1	0.5	4.1
9	.....	.....	0.5	4.1	0.5	4.1	0.5	4.1
10	.....	.....	0.5	4.1	0.6	6.7	0.5	4.1
11	.....	.....	0.45	3.1	0.7	9.4	0.5	4.1
12	.....	.....	0.5	4.1	0.7	9.4	0.5	4.1
13	.....	.....	0.6	6.7	0.6	6.7	0.5	4.1
14	.....	.....	0.5	4.1	0.6	6.7	0.4	2.3
15	.....	.....	0.5	4.1	0.6	6.7	0.4	2.3
16	.....	.....	0.55	5.4	0.6	6.7	0.4	2.3
17	.....	.....	0.5	4.1	0.7	9.4	0.4	2.3
18	.....	.....	0.45	3.1	0.7	9.4	0.4	2.3
19	.....	.....	0.5	4.1	0.6	6.7	0.7	9.4
20	.....	.....	0.5	4.1	0.55	5.4	1.7	44.0
21	.....	.....	0.7	9.4	0.55	5.4	1.6	40.3
22	.....	.....	0.6	6.7	0.55	5.4	0.6	6.7
23	.....	.....	0.8	12.25	0.55	5.4	0.5	4.1
24	.....	.....	0.8	12.25	0.55	5.4	0.5	4.1
25	.....	.....	0.9	15.4	0.5	4.1	0.5	4.1
26	0.5	4.1	0.8	12.25	0.5	4.1	0.5	4.1
27	0.6	6.7	0.8	12.25	0.44	2.95	0.5	4.1
28	0.4	2.3	0.6	6.7	0.5	4.1	0.5	4.1
29	0.6	6.7	0.6	6.7	0.5	4.1	0.5	4.1
30	0.7	9.4	0.5	4.1	0.5	4.1	0.4	2.3
31	0.7	9.4	.....	.....	0.5	4.1	.....	.....

DAILY Gauge Height and Discharge of Bone Creek at Lewis Ranche, for 1909—*Con.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
2	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
3	0.4	2.3	0.4	2.3	0.3	1.45	0.3	1.45
4	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
5	0.6	6.7	0.3	1.45	0.3	1.45	0.3	1.45
6	0.6	6.7	0.3	1.45	0.3	1.45	0.3	1.45
7	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
8	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
9	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
10	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
11	0.5	4.1	0.3	1.45	0.3	1.45	0.3	1.45
12	0.55	5.4	0.3	1.45	0.3	1.45	0.3	1.45
13	0.5	4.1	0.3	1.45	0.3	1.45	0.3	1.45
14	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
15	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
16	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
17	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
18	0.55	5.4	0.3	1.45	0.4	2.3	0.3	1.45
19	0.4	2.3	0.3	1.45	0.4	2.3	0.3	1.45
20	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
21	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
22	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
23	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
24	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
25	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
26	0.4	2.3	0.3	1.45	0.3	1.45	0.3	1.45
27	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
28	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
29	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
30	0.3	1.45	0.3	1.45	0.3	1.45	0.3	1.45
31	0.3	1.45	0.3	1.45	.....	.....	0.3	1.45

NOTE.—Discharges for gauge heights above 0.55 are obtained by producing rating curve through points of computed discharge.

MONTHLY Discharge of Bone Creek, at Lewis' Ranche, for 1908-9.

[Drainage area, 8 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square. mile.	Depth inches on Drainage area.	Total in acre-feet.
1908.						
July	2.3	1.45	1.67	.209	.241	103
August	4.1	1.6	2.16	.271	.312	133
September	2.3	1.45	1.82	.227	.253	108
October	56	1.8	6.51	.814	.938	400
The period	.....	.....	.....	.....	.....	744
1909.						
March (26–31)	9.4	2.3	6.4	.804	.179	77
April	15.4	2.3	5.9	.742	.828	353
May	12.2	2.9	6.1	.768	.885	378
June	44	2.3	6.5	.809	.903	385
July	6.7	1.45	2.57	.321	.370	158
August	2.3	1.45	1.48	.185	.213	91
September	2.3	1.45	1.51	.188	.210	90
October	1.45	1.45	1.45	.181	.209	89
The period	.....	.....	.....	.....	.....	1,621

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Measurements of Bone Creek, in 1909.

Date.	Hydrographer.	Locality.	Width.	Area of section.	Discharge.
July 9	H. R. Carscallen	Section 18–10–19–3 just above mouth.	13.5	23.5	31.3
September 22	....do	.....do	13.0	12.6	12.1

BRIDGE CREEK, NEAR SKULL CREEK, P. O.

This station was established July 29, 1909, by H. R. Carscallen. It is located at the highway bridge on the surveyed trail running eastward from Maple Creek on sec. 11, Tp. 11, R. 22, west of the 3rd meridian. It is about four miles from Skull Creek P. O., and twenty-seven miles from Maple Creek.

The channel is straight for 100 feet above and 30 feet below the station. Both banks are high and not liable to overflow. The stream is entirely devoid of tree growth. The bed of the creek is composed of clay and may shift somewhat at high stages. There is a small amount of vegetation at the station. The current is sluggish.

The gauge, which is read once each day by James Mann, is a rod, graduated to feet and hundredths, attached vertically to the centre pile on the downstream side of the bridge. The gauge is referred to bench marks as follows: (1.) The head of a spike surrounded by a circle of nail-heads in the top of the stringer at the right or east abutment on the downstream side of the bridge; elevation, 9.83 feet above gauge zero. (2.) The head of a spike in the top of a pointed 6″ wooden post firmly sunk into the ground on the left bank about 60 feet northwest of the gauge, the post blazed and marked B. M.; elevation 6.26 feet above gauge zero.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inner face of the left or west abutment. A centre row of piles, supporting the bridge, divides the stream into two channels. Low-water measurements are made near the station by wading, and at very low stages a weir is used.

DISCHARGE Measurements of Bridge Creek, near Skull Creek P. O., in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq.-ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
July 29	H. R. Carscallen	3.0	*	0.448	2.09	2.90
August 19	do	.....	.....	.....	.....	Nil.
September 17	do	.....	.....	.....	.....	Nil.

*Weir measurement.

DAILY Gauge Height and Discharge of Bridge Creek, near Skull Creek P. O., for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	1.5	0.83	*a*	.....	1.2	0.32
2	1.5	0.83	*a*	.....	1.2	0.32
3	1.3	0.48	*a*	.....	0.8	0.03
4	1.2	0.32	*a*	.....	0.5	0.00
5	1.1	0.18	*a*	.....	*a*	.....
6	1.0	0.10	*a*	.....	*a*	.....
7	0.9	0.06	*a*	.....	*a*	.....
8	1.1	0.18	*a*	.....	*a*	.....
9	1.0	0.10	*a*	.....	*a*	.....
10	0.9	0.06	*a*	.....	*a*	.....
11	0.8	0.03	*a*	.....	*a*	.....
12	0.7	0.01	*a*	.....	*a*	.....
13	0.7	0.01	*a*	.....	*a*	.....
14	0.6	0.00	*a*	.....	*a*	.....
15	0.5	0.00	*a*	.....	*a*	.....
16	*a*	.....	*a*	.....	*a*	.....
17	*a*	.....	*a*	.....	*a*	.....
18	*a*	.....	*a*	.....	*a*	.....
19	*a*	.....	*a*	.....	*a*	.....
20	*a*	.....	*a*	.....	*a*	.....
21	*a*	.....	*a*	.....	*a*	.....
22	*a*	.....	*a*	.....	*a*	.....
23	*a*	.....	*a*	.....	*a*	.....
24	*a*	.....	*a*	.....	*a*	.....
25	*a*	.....	*a*	.....	1.2	0.32
26	*a*	.....	*a*	.....	1.3	0.48
27	*a*	.....	*a*	.....	1.2	0.32
28	*a*	.....	1.0	0.10	1.2	0.32
29	*a*	.....	1.3	0.48	1.2	0.32
30	*a*	.....	1.2	0.32	1.2	0.32
31	*a*	.....	.....	.....	1.2	0.32

a—Creek dry at station Aug. 16 to Sept. 27 and Oct. 5 to 24, although a small flow in creek above station.

Skull Creek near Skull Creek P. O.

This station was established June 29, 1908, by F. T. Fletcher. It is located on sec. 10, Tp. 11, R. 22, west of the 3rd meridian, at the highway bridge on the surveyed trail running east from Maple Creek. It is about two miles north of Skull Creek P. O., and about twenty-five miles east of Maple Creek, by trail.

The channel is straight for 100 feet above and 150 feet below the station. Both banks are high and not liable to overflow. The banks are clear of brush for about 50 feet above and below the station, and then become densely wooded. The bed of the stream is composed of sand and may shift somewhat at high stages. The current is moderate.

The gauge, which is read once each day by James Mann, is a plain staff, graduated to feet and hundredths, attached vertically to the centre pile on the upstream or south side of the bridge. The gauge is referred to bench marks as follows: (1.) A bolt-head surrounded by a circle of nails in the top of the stringer at the right or east abutment on the upstream side of the bridge; elevation, 11.96 feet above the zero of the gauge. (2.) The top of the iron pin in the road mound about 50 feet southeast of the bridge on the right or east bank; elevation, 14.19 feet above the zero of the gauge.

Discharge measurements are made from the upstream side of the bridge. The initial point for soundings is the inner face of the right abutment of the bridge. There is only one channel at low stages, but owing to the centre row of piles supporting the bridge there are two channels at high stages of the stream. Low-water measurements are made at or near the gauge by wading, and at very low stages a weir is used.

Discharge Measurements of Skull Creek, near Skull Creek P. O., in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq.-ft*	*Ft. per sec.*	*Feet.*	*Sec.-ft*
June 26	F. T. Fletcher	3.0	*	0.19	.....	0.94
June 29	....do	3.0	*	0.29	1.10	1.54
July 1	....do	3.0	*	0.35	1.145	2.06
1909.						
April 16	F. T. Fletcher	6.5	3.48	1.99	2.55	6.94†
April 27	....do	21.7	37.1	1.20	3.23	44.5
April 28	....do	11.0	11.2	1.99	2.72	22.3
May 15	H. R. Carscallen	9.5	13.5	0.84	1.785	11.3
June 4	....do	6.3	3.20	0.99	0.94	3.19
June 24	....do	9.0	9.87	1.23	1.65	12.2
July 7	....do	8.3	6.34	1.26	1.235	8.02
July 29	....do	8.0	5.74	1.21	1.115	6.95
August 19	....do	1.25	*	0.256	0.53	0.52
September 17	....do	1.25	*	0.264	0.56	0.54

*Weir measurements.
†Ice conditions.

DAILY Gauge Height, in feet, of Skull Creek, near Skull Creek P. O., for 1908.

Day.	July.	August.	September.	October.	November.
1	1.3	*a*	0.6	0.4	3.6
2	0.9	*a*	0.6	0.6	*c*
3	0.8	*a*	0.5	0.7	*c*
4	0.7	*a*	0.4	0.8	3.7
5	0.9	*a*	0.4	0.9	3.6
6	0.9	*a*	0.4	1.0	3.1
7	0.8	*a*	0.5	0.8	3.1
8	0.7	*a*	0.3	1.1	*c*
9	9.6	*a*	0.8	1.1	*c*
10	0.5	0.7	0.6	1.0	*c*
11	0.3	0.8	0.2	1.0	*c*
12	0.2	0.7	0.2	1.0	*c*
13	0.2	0.7	0.2	1.1	*c*
14	0.2	0.7	0.2	1.1	*c*
15	0.6	0.7	*a*	1.2	*c*
16	0.6	0.7	*a*	1.2	*c*
17	1.0	0.6	*a*	1.2	3.0
18	1.0	0.4	*a*	1.2	3.6
19	0.8	0.2	*a*	1.3	3.2
20	0.7	0.2	*a*	*b*	3.0
21	0.5	0.2	0.7	*b*	3.0
22	0.2	0.2	0.7	*b*	2.7
23	*a*	0.2	0.6	*b*	2.0
24	*a*	0.4	0.5	2.0	1.6
25	*a*	0.3	0.8	2.6	1.3
26	*a*	0.8	0.9	2.9	1.2
27	*a*	0.8	0.9	3.0	*c*
28	*a*	0.6	0.9	3.6	*c*
29	*a*	0.5	0.8	*b*	*c*
30	*a*	0.5	0.7	*b*	*c*
31	*a*	0.8	.....	3.6	*c*

a Creek dry July 23 to August 9 and September 15-20. *b* Blizard, no observations. *c* Creek frozen.

DAILY Gauge Height and Discharge of Skull Creek, near Skull Creek P. O., for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.7	10.5	1.1	4.8	1.7	12.75
2	3.0	*b*	1.7	10.5	1.1	4.8	1.5	10.65
3	3.0	*b*	5.9	323 *c*	1.1	4.8	1.5	10.65
4	3.7	*b*	7.3	566 *c*	1.0	3.85	1.5	10.65
5	3.1	*b*	2.5	18.7	1.0	3.85	1.5	10.65
6	2.7	*b*	2.2	15.25	1.2	5.75	2.8	33.3 *c*
7	*a*	*b*	2.0	13.35	1.2	5.75	1.2	7.5
8	3.0	*b*	2.0	13.35	1.3	6.7	1.2	7.5
9	4.3	*b*	1.6	9.55	1.2	5.75	1.2	7.5
10	4.1	*b*	1.5	8.6	1.1	4.8	1.3	8.55
11	*a*	*b*	2.3	16.3	1.1	4.8	2.6	25.35*c*
12	*a*	*b*	2.7	22	1.0	3.85	3.5	75.7 *c*
13	*a*	*b*	2.8	24.3	1.0	3.85	2.5	22.85*c*
14	2.5	*b*	2.6	20.15	0.9	2.9	2.0	15.9 *c*
15	2.5	*b*	1.8	11.45	0.9	2.9	1.3	8.55
16	2.5	*b*	2.1	14.3	0.9	2.9	1.1	6.45
17	3.1	*b*	2.7	22	0.9	2.9	1.0	5.4
18	3.3	*b*	2.3	16.3	1.0	3.85	1.7	12.75
19	3.6	*b*	2.1	14.3	1.1	4.8	1.3	8.55
20	5.2	*b*	1.8	11.45	8.2	744 *c*	1.0	5.4
21	4.1	*b*	1.7	10.5	7.3	600 *c*	1.0	5.4
22	3.6	*b*	1.5	8.6	2.7	32 *c*	1.0	5.4
23	3.0	*b*	1.6	9.55	1.9	15	0.9	4.35
24	3.0	*b*	1.5	8.6	1.6	12	0.9	4.35
25	4.2	*b*	1.5	8.6	1.5	10.65	0.8	3.3
26	5.2	*b*	1.4	7.65	1.4	9.6	0.9	4.35
27	3.2	42.75	1.2	5.75	2.0	15.9 *c*	1.1	6.45
28	2.8	24.3	1.0	3.85	2.3	19.35*c*	1.4	9.6
29	2.2	15.25	1.2	5.75	1.6	11.7	1.1	6.45
30	2.0	13.35	1.1	4.8	3.4	69.3 *c*	1.1	6.45
31	.....	.....	1.1	4.8	.....	.....	1.0	5.4

a Creek frozen. *b* Apr. 2 to 26, ice in channel. *c* Discharges computed.

Daily Gauge Height and Discharge of Skull Creek, near Skull Creek, P. O., for 1909.—*Concluded.*

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.9	4.35	0.5	0.5	0.8	3.3
2	0.9	4.35	0.5	0.5	0.8	3.3
3	0.8	3.3	0.6	1.2	0.8	3.3
4	0.8	3.3	0.6	1.2	0.8	3.3
5	0.8	3.3	0.6	1.2	0.9	4.35
6	0.8	3.3	0.6	1.2	0.9	4.35
7	0.8	3.3	0.5	0.5	0.9	4.35
8	0.9	4.35	0.4	0.25	1.0	5.4
9	0.8	3.3	0.5	0.5	0.9	4.35
10	0.8	3.3	0.5	0.5	0.9	4.35
11	0.8	3.3	0.7	2.25	0.9	4.35
12	0.8	3.3	0.6	1.2	1.0	5.4
13	0.7	2.25	0.6	1.2	1.0	5.4
14	0.7	2.25	0.6	1.2	1.0	5.4
15	0.6	1.2	0.6	1.2	1.0	5.4
16	0.5	0.5	0.6	1.2	1.0	5.4
17	0.5	0.5	0.6	1.2	1.0	5.4
18	0.5	0.5	0.9	4.35	1.0	5.4
19	0.5	0.5	0.8	3.3	1.0	5.4
20	0.5	0.5	0.8	3.3	1.0	5.4
21	0.6	1.2	0.7	2.25	1.0	5.4
22	0.6	1.2	0.8	3.3	1.0	5.4
23	0.6	1.2	0.8	3.3	1.0	5.4
24	0.6	1.2	0.8	3.3	1.0	5.4
25	0.7	2.25	0.8	3.3	1.0	5.4
26	0.7	2.25	0.7	2.25	1.0	5.4
27	0.6	1.2	0.8	3.3	1.0	5.4
28	0.6	1.2	0.8	3.3	1.0	5.4
29	0.6	1.2	0.8	3.3	1.0	5.4
30	0.6	1.2	0.8	3.3	1.0	5.4
31	0.6	1.2	.....	.....	1.0	5.4

MONTHLY Discharge of Skull Creek, near Skull Creek P. O., for 1909.

[Drainage area, 43 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
April (27-30)	42.7	13.3	23.9	.556	.083	190
May	566	3.85	40.0	.930	1.072	2,459
June	744	2.90	54.1	1.258	1.404	3,219
July	75.7	3.3	11.9	.276	.318	730
August	4.35	0.5	2.14	.050	.058	131
September	4.35	0.25	1.96	.046	.051	117
October	5.4	3.3	4.93	.115	.133	303
The period	.....	.....	.....	.....	.....	7,149

Bear Creek near Unsworth's Ranche.

This station was established June 22, 1908, by F. T. Fletcher. It is located on sec. 18, Tp. 11, R. 23, west of the 3rd meridian at the highway bridge on the surveyed trail running east from Maple Creek. It is about one-half mile south of S. Unsworth's ranche, and fifteen miles east of Maple Creek.

The channel is straight for 100 feet above and below the station. Both banks are high and not liable to overflow. The station is kept clear of underbrush, but both banks are very densely wooded above and below the bridge. The bed of the stream is sandy and is subject to changes at high stages of the creek. The current is moderate, becoming sluggish at very low stages.

The gauge, which is read once each day by Mr. Unsworth, is a rod, graduated to feet and hundredths, attached vertically to the centre pile on the downstream side of the bridge. The gauge is referred to bench marks as follows: (1.) A circle of nail-heads in the top of the stringer at the left abutment on the downstream side of the bridge; elevation, 14.05 feet above the zero of the gauge. (2.) The top of the iron pin in the road mound southeast of the bridge on the left bank; elevation, 18.97 feet above the zero of the gauge.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inner face of the left abutment of the bridge. Low-water measurements are made at a wading section about one-half mile downstream from the gauge. There is only one channel at low stages, but at high stages the centre row of piles supporting the bridge divides the current into two channels.

Discharge Measurements of Bear Creek, near Unsworth's Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
June 22	F. T. Fletcher	8.5	13.7	0.46	1.00	6.42
1909.						
April 15	F. T. Fletcher	10.0	12.0	0.81	3.56	9.78*
April 26	....do	26.7	112	1.57	7.585	176
April 27	....do	21.8	74.8	1.42	6.05	106
May 14	H. R. Carscallen	11.0	32.0	1.27	3.425	40.7
June 3	....do	8.5	20.2	0.70	1.72	14.3
June 24	....do	18.5	65.4	1.56	4.935	102
July 7	....do	17.5	50.9	1.58	4.365	80.6
July 28	....do	8.0	23.4	1.12	2.29	26.3
August 16	....do	8.8	4.46	0.94	0.83	4.20
September 16	....do	9.0	5.06	0.87	0.84	4.38
November 12	....do	10.7	9.56	0.92	1.24	8.76

*Ice conditions.

DAILY Gauge Height and Discharge of Bear Creek, near Unsworth's Ranche, for 1908.

Day.	June.		July.		August.		September.		October.	
	Gauge Height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.3	9.4	0.4	2.3	1.2	8.4	1.2	8.4
2	.....	.....	1.2	8.4	0.4	2.3	1.2	8.4	1.2	8.4
3	.....	.....	1.1	7.4	0.4	2.3	1.2	8.4	1.2	8.4
4	.....	.....	1.0	6.45	0.4	2.3	1.1	7.4	1.3	9.4
5	.....	.....	1.0	6.45	0.4	2.3	1.1	7.4	1.3	9.4
6	.....	.....	1.1	7.4	0.3	1.8	1.0	6.45	1.3	9.4
7	.....	.....	1.1	7.4	0.3	1.8	1.0	6.45	1.4	10.5
7	.....	.....	1.0	6.45	0.3	1.8	0.9	5.55	1.4	10.5
9	.....	.....	1.0	6.45	0.8	4.75	0.9	5.55	1.4	10.5
10	.....	.....	0.9	5.55	1.0	6.45	0.9	5.55	1.4	10.5
11	.....	.....	0.9	5.55	1.1	7.4	0.8	4.75	1.4	10.5
12	.....	.....	0.8	4.75	1.2	8.4	0.8	4.75	1.4	10.5
13	.....	.....	0.7	4.05	1.3	9.4	0.8	4.75	1.4	10.5
14	.....	.....	0.6	3.45	1.2	8.4	0.7	4.05	1.4	10.5
15	.....	.....	0.7	4.05	1.2	8.4	0.7	4.05	1.5	11.6
16	.....	.....	0.7	4.05	1.2	8.4	0.6	3.45	1.5	11.6
17	.....	.....	0.8	4.75	1.2	8.4	0.6	3.45	1.5	11.6
18	.....	.....	1.0	6.45	1.2	8.4	0.6	3.45	1.6	12.7
19	.....	.....	1.1	7.4	1.2	8.4	0.6	3.45	1.6	12.7
20	.....	.....	1.0	6.45	1.2	8.4	0.7	4.05	1.6	12.7
21	.....	.....	1.0	6.45	1.2	8.4	0.7	4.05	1.6	12.7
22	1.0	6.45	0.9	5.55	1.2	8.4	0.7	4.05	2.0	17.8
23	1.0	6.45	0.8	4.75	1.2	8.4	0.7	4.05	2.6	26.65
24	0.9	5.55	0.7	4.05	1.2	8.4	0.7	4.05	2.8	29.8
25	0.9	5.55	0.7	4.05	1.3	9.4	0.8	4.75	2.6	26.65
26	0.9	5.55	0.6	3.45	1.3	9.4	0.8	4.75	2.4	23.6
27	1.0	6.45	0.6	3.45	1.2	8.4	0.8	4.75	2.2	20.6
28	1.0	6.45	0.6	3.45	1.2	8.4	0.8	4.75	2.1	19.2
29	1.0	6.45	0.5	2.85	1.2	8.4	0.9	5.55	2.1	19.2
30	1.1	7.4	0.5	2.85	1.2	8.4	0.9	5.55	2.1	19.2
31	.....	.....	0.4	2.3	1.2	8.4	.....	.....	2.0	17.8

DAILY Gauge Height and Discharge of Bear Creek, near Unsworth's Ranche, for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sect.-ft.*
1	4.7	*a*	3.8	47.9	2.1	19.2	3.7	61.
2	4.8	*a*	4.0	52	2.1	19.2	3.5	55.5
3	4.7	*a*	5.6	90.6	1.8	15	3.0	43.6
4	4.6	*a*	7.1	151	1.7	13.8	3.0	43.6
5	4.3	*a*	8.8	257	1.7	13.8	3.0	43.5
6	4.8	*a*	5.6	90.6	1.8	15	3.6	58
7	4.9	*a*	3.8	47.9	1.8	15	4.4	82
8	5.6	*a*	3.3	38.4	1.9	16.4	4.1	71.5
9	6.1	*a*	3.0	33.1	1.9	16.4	2.9	40.8
10	7.0	*a*	3.4	40.2	1.9	16.4	2.7	36.7
11	4.1	*a*	4.1	54.1	1.8	15	2.6	34.5
12	4.0	*a*	4.2	56.2	1.7	13.8	3.6	57.1
13	3.5	*a*	3.8	47.9	1.6	12.7	4.1	71
14	3.5	*a*	3.4	40.2	1.5	11.6	4.5	83.2
15	3.7	*a*	3.2	36.6	1.5	11.6	3.8	61.7
16	3.8	*a*	3.1	34.9	1.5	11.6	3.2	46.5
17	3.8	*a*	3.6	44	1.7	13.8	3.0	42
18	4.8	*a*	4.0	52	1.7	13.8	2.9	39.6
19	5.0	*a*	4.2	56.2	1.8	15	2.8	37.2
20	5.1	*a*	3.9	49.9	4.3	58.3	2.5	31.2
21	6.0	*a*	3.6	44	14	741	2.3	27.5
22	6.3	*a*	3.1	34.8	11.7	496	2.3	27
23	4.8	69.3	3.3	38.4	10.2	430	2.2	25
24	3.8	47.9	4.2	56.2	4.8	97	2.0	21.2
25	5.6	90.6	4.1	54.1	4.2	76.4	1.8	17.7
26	7.6	1.78	3.2	36.6	4.0	70.5	1.6	14.2
27	6.2	112	2.7	28.2	4.1	73.1	1.4	11.1
28	4.1	54.1	2.4	23.6	4.2	75.9	2.3	26.5
29	3.0	33.1	2.3	22.1	4.3	79	2.2	24.5
30	2.8	29.8	2.3	22.1	4.1	72.8	2.0	20.9
31	.....	.....	2.2	20.6	.....	.....	1.7	15.7

a—Ice in channel April 1st to 22nd.

NOTE.—Discharges for all gauge heights above 8.00 feet are computed.

DAILY Gauge Height and Discharge of Bear Creek, near Unsworth's Ranche, for 1909.—*Concluded.*

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft*
1	1.6	14.1	0.7	3.1	1.1	7.1
2	1.5	12.5	0.7	3.1	1.1	7.1
3	1.5	12.5	0.7	3.1	1.1	7.1
4	1.4	11	0.7	3.1	1.1	7.1
5	1.4	11	0.7	3.1	1.2	8.3
6	1.3	9.6	0.7	3.1	1.2	8.3
7	1.3	9.6	0.7	3.1	1.2	8.3
8	1.2	8.3	0.7	3.1	1.3	9.6
9	1.2	8.3	0.7	3.1	1.3	9.6
10	1.2	8.3	0.7	3.1	1.3	9.6
11	1.1	7.1	0.7	3.1	1.3	9.6
12	1.1	7.1	0.9	5	1.3	9.6
13	1.1	7.1	1.0	6	1.3	9.6
14	1.1	7.1	0.9	5	1.3	9.6
15	1.0	6	0.9	5	1.4	11
16	0.9	5	0.8	4	1.4	11
17	0.8	4	0.8	4	1.4	11
18	0.8	4	0.8	4	1.4	11
19	0.8	4	0.9	5	1.4	11
20	0.7	3.1	1.1	7.1	1.4	11
21	0.7	3.1	1.2	8.3	1.4	11
22	0.7	3.1	1.3	9.6	1.4	11
23	0.7	3.1	1.2	8.3	1.4	11
24	0.6	2.3	1.2	8.3	1.4	11
25	0.6	2.3	1.1	7.1	1.5	12.5
26	0.6	2.3	1.1	7.1	1.5	12.5
27	0.6	2.3	1.0	6	1.5	12.5
28	0.6	2.3	1.0	6	1.5	12.5
29	0.7	3.1	1.0	6	1.5	12.5
30	0.7	3.1	1.0	6	1.5	12.5
31	0.7	3.1	.....	.....	1.5	12.5

MONTHLY Discharge of Bear Creek, near Unsworth's Ranche, for 1908-9.

[Drainage area, 95 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on Drainage. area.	Total in acre-feet.
1908.						
June (22–30)	7.4	5.55	6.26	.066	.022	112
July	9.4	2.3	5.34	.056	.065	328
August	9.4	1.8	6.66	.070	.081	409
September	8.4	3.45	5.2	.055	.061	309
October	29.8	8.4	14.3	.151	.174	880
The period						2,038
1909.						
April (23–30)	178	29.8	76.8	.809	.241	1,219
May	257	20.6	54.9	.578	.666	3,374
June	741	11.6	85.0	.894	.997	5,056
July	83.2	11.1	41.0	.432	.498	2,522
August	14.1	2.3	6.1	.064	.074	376
September	9.6	3.1	5.1	.053	.059	301
October	12.5	7.1	10.3	.108	.124	631
The period						13,479

EAST BRANCH OF BEAR CREEK AT JOHNSON'S RANCHE.

This station was established August 18, 1909, by H. R. Carscallen. It is located on sec. 21, Tp. 10, R. 23, west of the 3rd meridian, about a mile and a half southeast of Skibereen P.O.

The channel is straight for 50 feet above and 40 feet below the station. Both banks are high and not liable to overflow, unless in cases of extreme floods. The banks are free from brush at the station, but are wooded above and below. The bed of the stream is composed of coarse gravel and stones. The large stones in the bed of the stream make accurate soundings at the station rather difficult to obtain. The current is moderate.

The gauge, which is read once each day by Ralph Johnson, is a plain staff, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the stream at the right bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) A spike-head in the top of a pointed black-birch stump about 40 feet southeast of the gauge on the right bank, the stump blazed and marked B. M.; elevation, 8.99 feet above the zero of the gauge. (2.) A spike head in the top of a pointed black-birch stump, about 30 feet northeast of the gauge on the right bank, the stump blazed and marked B. M.; elevation, 6.89 feet above the zero of the gauge.

Discharge measurements are made at or near the gauge by wading. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o.o.

DISCHARGE Measurements of East Branch of Bear Creek, at Johnson's Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq.-ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft*
August 18	H. R. Carscallen	13.0	4.88	0.39	1.15	1.92
September 15	....do	8.4	4.48	0.48	1.19	2.15
November 11	....do	9.0	4.83	0.62	1.28	2.98

DAILY Gauge Height and Discharge of East Branch of Bear Creek, at Johnson's Ranche, for 1909.

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.1	1.5	1.2	2.25
2	.....	.....	1.1	1.5	1.2	2.25
3	.....	.....	1.1	1.5	1.2	2.25
4	.....	.....	1.1	1.5	1.2	2.25
5	.....	.....	1.1	1.5	1.2	2.25
6	.....	.....	1.1	1.5	1.2	2.25
7	.....	.....	1.1	1.5	1.2	2.25
8	.....	.....	1.1	1.5	1.2	2.25
9	.....	.....	1.1	1.5	1.2	2.25
10	.....	.....	1.1	1.5	1.2	2.25
11	.....	.....	1.2	2.25	1.2	2.25
12	.....	.....	1.3	3.15	1.3	3.15
13	.....	.....	1.2	2.25	1.2	2.25
14	.....	.....	1.2	2.25	1.2	2.25
15	.....	.....	1.2	2.25	1.3	3.15
16	.....	.....	1.2	2.25	1.2	2.25
17	.....	.....	1.1	1.5	1.3	3.15
18	1.1	1.5	1.2	2.25	1.3	3.15
19	1.2	2.25	1.2	2.25	1.3	3.15
20	1.1	1.5	1.2	2.25	1.3	3.15
21	1.1	1.5	1.2	2.25	1.3	3.15
22	1.1	1.5	1.2	2.25	1.3	3.15
23	1.1	1.5	1.2	2.25	1.3	3.15
24	1.2	2.25	1.2	2.25	1.3	3.15
25	1.2	2.25	1.2	2.25	1.3	3.15
26	1.2	2.25	1.2	2.25	1.3	3.15
27	1.1	1.5	1.2	2.25	1.3	3.15
28	1.1	1.5	1.2	2.25	1.3	3.15
29	1.1	1.5	1.2	2.25	1.3	3.15
30	1.1	1.5	1.2	2.25	1.3	3.15
31	1.1	1.5	.....	.....	1.3	3.15

MONTHLY Discharge of East Branch of Bear Creek, at Johnson's Ranche, for 1909.

[Drainage area, 27 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
August (18-31)	2.25	1.5	1.71	.063	.033	48
September	3.15	1.5	2.00	.074	.082	119
October	3.15	2.25	2.74	.102	.117	168
The period	.....	.....	.....	.....	.....	335

DISCHARGE Measurements of West Branch of Bear Creek, at Bertram's Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*F. per Sec.*	*Feet.*	*Sec.-ft.*
June 19	F. T. Fletcher	9.0	3.41	2.09	.....	7.12*
October 27	....do	11.0	5.68	1.24	.....	6.93*
1909.						
September 16	H. R. Carscallen	11.5	5.18	0.58	1.385	3.00
November 11	....do	12.0	6.34	0.93	1.56	5.92

*Measurements made on sec. 29, tp. 10, range 23, west of the 3rd meridian, the section south of that on which the gauge is located.

WEST BRANCH OF BEAR CREEK AT BERTRAM'S RANCHE.

This station was established September 16, 1909, by H. R. Carscallen. It is located on sec. 32, Tp. 10, R. 23, west of the 3rd meridian, about a mile and a half north of Skibereen P. O. The station is about three hundred yards above the junction of this branch with the East branch of Bear Creek.

The channel is straight for 25 feet above and 15 feet below the station. Both banks are comparatively high and will overflow only in cases of extreme floods. The banks are free from brush at the station, but are heavily wooded immediately above and twenty feet below. The bed of the creek is composed of sand and coarse gravel. The current is moderate at the station, but becomes very swift twenty feet downstream.

The gauge, which is read once each day by Charles Bertram, is a plain staff, graduated to feet and hundredths, attached vertically to a post sunk in the bed of the stream at the left bank and firmly stayed to the bank. The gauge is referred to bench marks as follows: (1.) A spike-head in the top of the initial point stake on the left bank, marked B. M.; elevation, 8.00 above the zero of the gauge. (2.) A spike-head in the top of a pointed poplar stump just below the bank on the left side of the stream, and about 50 feet downstream from the gauge, the stump blazed and marked B. M.; elevation, 8.41 feet above the zero of the gauge.

Discharge measurements are made at, or a short distance below, the gauge by wading. High-water measurements may be made at the government bridge, situated about three-quarters of a mile upstream. The initial point for soundings at the station is a square stake driven close to the ground on the left bank and marked I.P. o.o.

DAILY Gauge Height and Discharge of West Branch of Bear Creek, at Bertram's Ranche, for 1909.

Day.	September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.4	3.2
2	.....	.....	1.4	3.2
3	.....	.....	1.5	4.8
4	.....	.....	1.5	4.8
5	.....	.....	1.5	4.8
6	.....	.....	1.5	4.8
7	.....	.....	1.7	9
8	.....	.....	1.7	9
9	.....	.....	1.6	6.7
10	.....	.....	1.6	6.7
11	.....	.....	1.7	9
12	.....	.....	1.7	9
13	.....	.....	1.7	9
14	.....	.....	1.7	9
15	.....	.....	1.7	9
16	1.4	3.2	1.7	9
17	1.4	3.2	1.6	6.7
18	1.7	9	1.5	4.8
19	1.6	6.7	1.5	4.8
20	1.6	6.7	1.5	4.8
21	1.6	6.7	1.5	4.8
22	1.6	6.7	1.5	4.8
23	1.5	4.8	1.5	4.8
24	1.5	4.8	1.6	6.7
25	1.5	4.8	1.6	6.7
26	1.5	4.8	1.6	6.7
27	1.4	3.2	1.6	6.7
28	1.4	3.2	1.6	6.7
29	1.4	3.2	1.6	6.7
30	1.4	3.2	1.6	6.7
31	.....	.....	1.6	6.7

MONTHLY Discharge of West Branch of Bear Creek, at Bertram's Ranche, for 1909.

[Drainage area, 44.5 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
September (16-30)	9	3.2	4.95	.111	.062	147
October	9	3.2	6.45	.145	.167	397
The period	.....	.....	.....	.....	.....	544

Miscellaneous Measurements.

Miscellaneous Discharge Measurements of Glennie Creek, in 1908-9.

Date.	Hydrographer.	Locality.	Weir dimensions.		Discharge.
			Breadth.	Head.	
1908.			*Feet.*	*Feet.*	*Sec.-ft.*
June 19	F. T. Fletcher	Sec. 25-10-24-3	3.0	0.16	0.61
1909.					
August 18	H. R. Carscallen	Sec. 30-10-23-3, just above dam.	1.25	0.059	0.06
September 15	....do	.....do	1.25	0.107	0.14

Miscellaneous Discharge Measurements of a spring creek in sec. 8, Tp. 11, R. 23, west of the 3rd meridian, in 1909.

Date.	Hydrographer.	Locality.	Weir dimensions.		Discharge.
			Breadth.	Head.	
			Feet.	*Feet.*	*Sec.-ft.*
August 17	H. R. Carscallen	Sec. 8-11-23-3	1.25	0.23	0.44
September 16	....do	.....do	1.25	0.24	0.47

Piapot Creek at Cumberland's Ranche.

This station was established June 17, 1908, by F. T. Fletcher. It was located on sec. 17, Tp. 11, R. 24, west of the 3rd meridian, at the highway bridge on the surveyed trail running east of Maple Creek and about nine miles from Maple Creek. This station, on account of the difficulty of obtaining an observer, was abandoned May 13, 1909, and re-established by H. R. Carscallen at a wading section near A. Cumberland's house. It is located about a mile north of the old station on sec. 18, Tp. 11, R. 24, west of the 3rd meridian.

The channel is straight for 50 feet above and 100 feet below the station. The right bank is high and not liable to overflow; the left bank is comparatively low and will overflow at flood stages of the stream. The bed of the stream is composed of sand and may shift during high stages. The current is sluggish.

The gauge, which is read once each day by Mr. Cumberland, is a rod, graduated to feet and hundredths, attached vertically to a post sunk in the bed of the stream at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) The top of two spikes driven horizontally into the end of a log at the southwest corner of Mr. Cumberland's old house; elevation, 12.72 feet above the zero of the gauge. (2.) A spike-head surrounded by a circle of nail-heads in the top of a log at the northwest corner of the out-building south of Mr. Cumberland's house; elevation, 11.70 feet above the zero of the gauge.

Discharge measurements are made at or near the gauge by wading. High-water measurements are made at the first established station, from the downstream side of the bridge. The initial point is the inner face of the left abutment of the bridge. Owing to a centre row of piles there are two channels at high water.

DISCHARGE Measurements of Piapot Creek, at Cumberland's Ranche, in 1908-9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
1908.						
October 18	F. T. Fletcher	4.5	0.99	0.93	0.54	0.93
1909.						
April 15	F. T. Fletcher	9.6	8.43	1.05	.....	8.81*
April 26	....do	8.3	12.0	1.85	1.37	22.2
May 5	....do	8.0	18.2	2.56	2.04	46.5
May 11	H. R. Carscallen	6.9	10.9	2.39	1.445	26.2
May 13	....do	12.0	12.4	1.26	1.805	15.6
June 3	....do	9.5	5.06	0.90	1.16	4.56
June 21	....do	37.7	172	2.81	6.625	464
June 23	....do	13.0	27.7	1.87	2.94	52
June 24	....do	12.8	23.3	1.75	2.615	40.8
July 6	....do	11.5	23.2	1.73	2.54	40.1
July 28	....do	13.0	14.4	0.79	1.69	11.5
August 14	....do	12.7	7.36	0.36	1.15	2.69
September 14	....do	9.7	7.68	0.38	1.135	2.96
November 9	....do	7.7	4.42	0.73	1.15	3.22

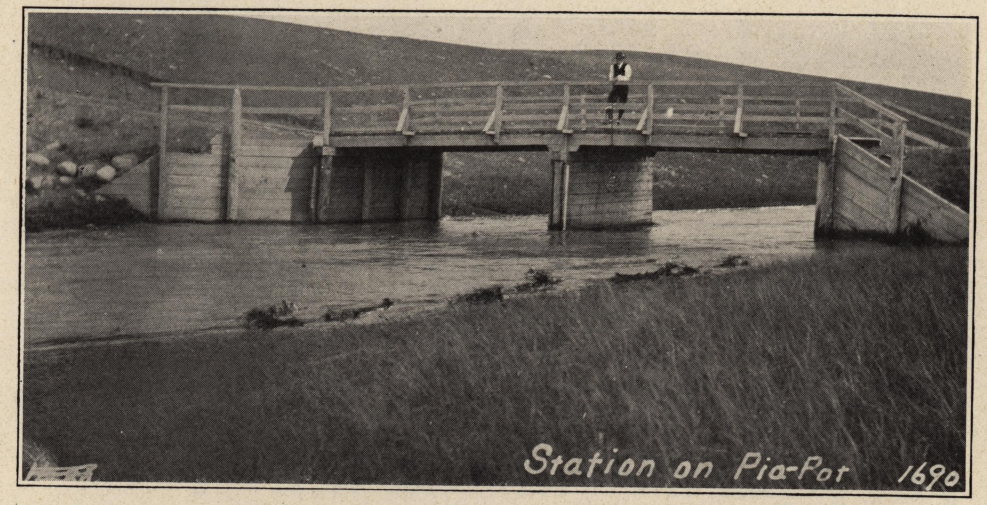
*Ice conditions.

NOTE.—Gauge heights previous to and including that for the measurement made on May 11, 1909, refer to the gauge on the traffic bridge; gauge heights after May 11, 1909, refer to the gauge at Cumberland's Ranche.

DAILY Gauge Height, in feet, of Piapot Creek, near Cumberland's Ranche, for 1908.

Day.	July.	August.	September.	October.
1	.....	*	0.5	0.5
2	.....	*	0.5	0.5
3	.....	*	0.5	0.5
4	0.5	*	0.5	0.5
5	0.5	*	0.5	0.5
6	0.5	*	0.5	0.5
7	0.5	*	0.5	0.5
8	0.6	0.6	0.5	0.5
9	0.5	0.5	0.5	0.5
10	0.5	0.4	0.5	0.5
11	0.5	0.4	0.5	0.5
12	0.5	0.6	0.5	0.5
13	0.6	0.5	0.5	0.5
14	0.6	0.5	0.5	0.5
15	0.6	0.5	0.5	0.6
16	0.6	0.5	0.5	0.6
17	0.8	0.5	0.5	0.6
18	0.6	0.5	0.5	0.5
19	0.5	0.4	0.6	0.6
20	0.5	0.4	0.5	†
21	0.5	0.5	0.5	†
22	0.5	0.5	0.5	†
23	0.4	1.3	0.5	†
24	0.3	0.7	0.5	†
25	0.3	0.7	0.5	†
26	0.3	0.6	0.5	†
27	0.3	0.5	0.5	1.3
28	0.3	0.5	0.5	†
29	0.3	0.5	0.5	†
30	*	0.5	0.5	†
31	*	0.5	.....	†

*Creek dry July 30 to August 7. †Creek frozen October 20 to 26 and after October 27.



Gauging Station on Piapot Creek, near Cumberland's Ranche.

DAILY Gauge Height and Discharge of Piapot Creek, at Cumberland's Ranche, for 1909.

Day.	May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	0.6*	4.9	1.2	3.6	2.0	20.1
2	0.6*	4.9	1.2	3.6	1.6	9.9
3	1.4*	23.3	1.15	3.15	1.3	4.8
4	2.1*	48.8	1.0	2	1.5	8
5	2.1*	48.8	0.85	1.35	2.35	31.9
6	1.7*	33.8	1.0	2	2.5	37.4
7	1.0*	11.7	1.15	3.15	1.9	17.2
8	0.8*	7.7	1.2	3.6	1.6	9.9
9	0.8*	7.7	1.3	4.8	1.6	9.9
10	1.1*	14.1	1.2	3.6	1.6	9.9
11	1.4*	23.3	1.2	3.6	1.8	14.6
12	2.1	23.3	1.2	3.6	3.1	63.8
13	1.7	12.1	1.1	2.7	2.7	44.9
14	1.5	8	1.1	2.7	2.2	26.5
15	1.45	7.15	1.0	2	1.9	17.2
16	1.45	7.15	1.0	2	1.8	14.6
17	2.0	20.1	1.2	3.6	2.0	20.1
18	2.1	23.3	1.1	2.7	2.2	26.5
19	2.0	20.1	1.2	3.6	1.7	12.1
20	1.6	9.9	4.85	209	1.6	9.9
21	1.6	9.9	7.15	552†	1.6	9.9
22	1.7	12.1	4.3	151	1.4	6.3
23	3.05	61.2	2.9	53.6	1.4	6.3
24	2.0	20.1	2.4	33.7	1.4	6.3
25	1.7	12.1	2.4	33.7	1.4	6.3
26	1.55	8.9	1.8	14.6	1.6	9.9
27	1.5	8	1.9	17.2	1.6	9.9
28	1.45	7.15	2.1	23.3	2.3	30
29	1.3	4.8	1.8	14.6	2.0	20.1
30	1.2	3.6	1.9	17.2	1.5	8
31	1.25	4.2	.....	.....	1.4	6.3

*Gauge height observations made at bridge on Sec. 17-11-24-3, from May 1 to 11.
†Discharge computed.

DAILY Gauge Height and Discharge of Piapot Creek, at Cumberland's Ranche, for 1909. —*Concluded.*

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.ft.*	*Feet.*	*Sec.-ft.*
1	1.5	8	1.1	2.7	1.1	2.7
2	1.4	6.3	1.1	2.7	1.1	2.7
3	1.4	6.3	1.1	2.7	1.1	2.7
4	1.3	4.8	1.1	2.7	1.1	2.7
5	1.3	4.8	1.1	2.7	1.1	2.7
6	1.3	4.8	1.1	2.7	1.1	2.7
7	1.3	4.8	1.1	2.7	1.1	2.7
8	1.2	3.6	1.1	2.7	1.1	2.7
9	1.2	3.6	1.0	2	1.1	2.7
10	1.2	3.6	1 1	2.7	1.1	2.7
11	1.2	3.6	1.2	3.6	1.1	2.7
12	1.2	3.6	1.1	2.7	1.1	2.7
13	1.1	2.7	1.1	2.7	1.1	2.7
14	1.1	2.7	1.1	2.7	1.1	2.7
15	1.1	2.7	1.1	2.7	1.1	2.7
16	1.1	2.7	1.1	2.7	1.1	2.7
17	1.1	2.7	1.1	2.7	1.1	2.7
18	1.1	2.7	1.1	2.7	1.1	2.7
19	1.1	2.7	1.1	2.7	1.1	2.7
20	1.1	2.7	1.1	2.7	1.1	2.7
21	1.1	2.7	1.1	2.7	1.1	2.7
22	1.1	2.7	1.1	2.7	1.1	2.7
23	1.1	2.7	1.1	2.7	1.1	2.7
24	1.1	2.7	1.1	2.7	1.1	2.7
25	1.1	2.7	1.1	2.7	1.1	2.7
26	1.1	2.7	1.1	2.7	1.1	2.7
27	1.1	2.7	1.1	2.7	1.1	2.7
28	1.1	2.7	1.1	2.7	1.1	2.7
29	1.1	2.7	1.1	2 7	1.1	2.7
30	1.1	2.7	1.1	2.7	1.1	2.7
31	1.1	2.7	.....	.....	1.1	2.7

MONTHLY Discharge of Piapot Creek, at Cumberland's Ranche, for 1909.

[Drainage area, 50 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
May	48.8	3.6	16.5	.330	.380	1,016
June	552	1.35	39.2	.785	.876	2,335
July	63.8	4.8	17.0	.341	.393	1,048
August	8	2.7	3.52	.070	.081	216
September	3.6	2	2.71	.054	.060	161
October	2.7	2.7	2.7	.054	.062	166
The period	.....	.....	.....	.....	.....	4,942

HAY CREEK AT FAUQUIER'S RANCHE.

This station was established April 22, 1909, by F. T. Fletcher. It is located on sec. 30, Tp. 10, R. 25, west of the 3rd meridian, about seven miles southeast of Maple Creek.

The channel is straight for 100 feet above and 200 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of sand and coarse gravel and may shift at high stages. The current is sluggish.

The gauge, which is read daily by H. Fauquier, is a plain staff, graduated to feet and hundredths, attached to a vertical post sunk in the bed of the stream at the left bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1.) A spike-head in the top of the initial point stake on the left bank, marked B. M.; elevation, 6.62 feet above the zero of the gauge. (2.) A "broad arrow" marked with red paint on a large rock in the foundation of a frame out-building close to the gauge; elevation, 9.34 feet above the zero of the gauge.

Discharge measurements are made near the regular station by wading, and at very low stages a weir is used. The initial point for soundings is a square stake driven close to the ground on the left bank and marked I.P. o.o. High-water measurements are not obtainable owing to the absence of any structure from which to gauge the stream at high stages. The gauge is situated below the intake of Mr. Fauquier's irrigation ditch, and also below the intake of the Maple Creek Waterworks Reservoir. Hence, records of flow obtained at the gauge do not include this diverted water, and do not represent the total discharge of the stream. The flow of springs below the Maple Creek Waterworks intake, together with drainage, and the overflow from the Maple Creek Waterworks Reservoir give a continuous flow in the creek-bed above the station. This flow, which depends very largely upon the overflow from the Reservoir, varies greatly, depending upon the consumption of water by the town of Maple Creek and by the C. P. Railway. The disappearance of this water before reaching the gauge is explained, in part, by the fact that Mr. Fauquier diverts water into his irrigation ditch. The remainder of the water must seep through the gravel of the creek-bed between the intake of the ditch and the gauge. The fact that springs break out a short distance below the gauge and give a continuous flow (so far as is known) seems to bear out the seepage theory.

DISCHARGE Measurements of Hay Creek, at Fauquier's Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 31	P. M. Sauder	5.0	4.05	1.11	.....	4.49
April 22	F. T. Fletcher	6.0	4.58	0.56	.....	2.58
April 24	....do	5.5	4.14	0.78	1.295	3.22
May 5	....do	6.5	6.72	1.35	1.87	9.08
May 11	H. R. Carscallen	7.2	6.89	1.21	1.84	8.34
May 31	....do	6.2	2.22	0.26	1.025	0.57
June 23	....do	8.1	7.67	2.05	1.775	15.7
July 6	....do	7.0	4.78	0.70	1.12	3.34
July 27	....do	1.25	*	0.12	0.74	0.17
August 13	....do	.....	.....	.....	0.15	Nil.†
August 14	....do	.....	.....	.....	0.03	Nil.†
September 13	....do	.....	.....	.....	.....	Nil.†
October 1	....do	.....	.....	.....	.....	Nil.†
November 8	....do	.....	.....	.....	.....	Nil.†

*Weir measurement.
†No flow in creek at station. There is a small discharge above but it never reaches the gauge.

DAILY Gauge Height and Discharge of Hay Creek, at Fauquier's Ranche, for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	1.7	6.5	1.0	0.5	0.9	1.15
2	.....	.....	1.6	5.2	0.9	0.2	0.8	0.5
3	.....	.....	2.0	11.1	0.9	0.2	0.8	0.5
4	.....	.....	2.1	12.9	0.7	0.05	0.8	0.5
5	.....	.....	1.9	9.45	0.65	0.00	0.9	1.15
6	.....	.....	1.7	6.5	*	0.00	1.0	2
7	.....	.....	1.7	6.5	*	0.00	0.9	1.15
8	.....	.....	1.6	5.2	0.8	0.1	0.8	0.5
9	.....	.....	1.6	5.2	0.9	0.2	0.8	0.5
10	.....	.....	1.7	6.5	0.9	0.2	0.8	0.5
11	.....	.....	1.9	9.45	0.9	0.2	0.8	0.5
12	.....	.....	1.8	7.9	0.8	0.1	1.5	9.6
13	.....	.....	1.8	7.9	0.9	0.2	1.2	4.4
14	.....	.....	1.7	6.5	0.8	0.1	0.9	1.15
15	.....	.....	1.6	5.2	0.7	0.05	0.8	0.5
16	.....	.....	1.6	5.2	*	.....	0.8	0.5
17	.....	.....	2.0	11.1	*	.....	0.7	0.15
18	.....	.....	1.9	9.45	*	.....	0.8	0.5
19	.....	.....	1.9	9.45	0.8	0.1	0.8	0.5
20	.....	.....	1.6	5.2	4.7	†	0.7	0.15
21	.....	.....	1.6	5.2	4.1	†	0.7	0.15
22	.....	.....	1.6	5.2	2.4	†	0.7	0.15
23	.....	.....	2.4	19.2	1.7	13.9	0.7	0.15
24	.....	.....	2.0	11.1	1.4	7.65	0.7	0.15
25	1.8	7.9	1.8	7.9	1.3	5.95	0.7	0.15
26	1.9	9.45	1.6	5.2	1.1	3.1	0.7	0.15
27	1.7	6.5	1.7	6.5	1.0	2	0.7	0.15
28	1.7	6.5	1.6	5.2	1.1	3.1	0.9	1.15
29	1.4	3	1.2	1.4	1.1	3.1	0.7	0.15
30	1.0	0.5	1.1	0.9	1.0	2	0.7	0.15
31	.....	.....	1.1	0.9	.....	.....	0.7	0.15

DAILY Gauge Height and Discharge of Hay Creek, at Fauquier's Ranche, for 1909.—*Con.*

Day.	August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*				
1	0.6	0.0	*	.....	*	.....
2	0.6	0.0	*	.....	*	.....
3	0.6	0.0	*	.....	*	.....
4	0.6	0.0	*	.....	*	.....
5	0.6	0.0	*	.....	*	.....
6	0.6	0.0	*	.....	*	.....
7	0.6	0.0	*	.....	*	.....
8	0.6	0.0	*	.....	*	.....
9	0.6	0.0	*	.....	*	.....
10	*	.....	*	.....	*	.....
11	*	.....	*	.....	*	.....
12	*	.....	*	.....	*	.....
13	*	.....	*	.....	*	.....
14	*	.....	*	.....	*	.....
15	*	.....	*	.....	*	.....
16	*	.....	*	.....	*	.....
17	*	.....	*	.....	*	.....
18	*	.....	*	.....	*	.....
19	*	.....	*	.....	*	.....
20	*	.....	*	.....	*	.....
21	*	.....	*	.....	*	.....
22	*	.....	*	.....	*	.....
23	*	.....	*	.....	*	.....
24	*	.....	*	.....	*	.....
25	*	.....	*	.....	*	.....
26	*	.....	*	.....	*	.....
27	*	.....	*	.....	*	.....
28	*	.....	*	.....	*	.....
29	*	.....	*	.....	*	.....
30	*	.....	*	.....	*	.....
31	*	.....	.....	.....	*	.....

*Creek dry at station June 6, 7, 16, 17 and 18, and August 10—October 31.

†Data insufficient for computation of discharges.

NOTE.—Discharges do not include water used by Maple Creek Waterworks or that used by H. Fauquier for irrigation purposes.

MISCELLANEOUS MEASUREMENTS.

MISCELLANEOUS Discharge Measurements of Hay Creek, in 1909.

Date.	Hydrographer.	Locality.	Weir dimensions.		Discharge.
			Breadth.	Head.	
			Feet.	*Feet.*	*Sec.-ft.*
September 13	H. R. Carscallen	Road allowance between Townships 10 and 11-25-3	1.25	0.105	0.14
September 13	....do	S.E.¼, of section 5-11-25-3.	1.25	*0.125	0.18

*Measurement made below the point where the waste water from Mr. Peecock's hydraulic ram enters the creek.

Maple Creek near Maple Creek, Sask.

This station was established May 9, 1908, by R. J. Burley. It is located at the highway bridge just north of the C. P. Railway tracks in the town of Maple Creek.

The channel is straight for 200 feet above and 100 feet below the station. Both banks are comparatively low and will overflow at high-water stages of the stream. The bed of the stream is composed of sand and may shift during flood stages. The current is moderate at high and sluggish at low stages of the stream. The bridge is not at right angles to the flow and measurements made at the bridge must be corrected.

The gauge, which is read daily by C. A. Peterson, is a plain staff, graduated to feet and hundredths, attached vertically to a pile on the upstream side of the bridge. The gauge is referred to bench marks as follows: (1.) A spike-head in the top of a small pile on the right bank at the upstream side of the bridge; elevation, 8.04 feet above the zero of the gauge. (2.) Nail-heads in the top of the stringer at the right abutment on the upstream side of the bridge; elevation, 8.14 feet above the zero of the gauge. (3.) An "arrow head" painted in black on the top of a long pile in the bed of the creek near the left bank and on the upstream side of the bridge; elevation, 8.64 feet above the zero of the gauge.

Discharge measurements are made from the downstream side of the bridge. The initial point for sounding is the inner face of the right or south abutment of the bridge. Low-water measurements are made at a point about 50 feet upstream from the gauge by wading, and at very low stages a weir is used. The light, sandy soil of the banks gives rise to a great amount of erosion during flood stages, and this fact, coupled with that of the low banks of the stream, makes this station a rather unsatisfactory one for gauging purposes. During the latter part of the season of 1909 it was noticed that the creek was perfectly dry three-quarters of a mile upstream from the gauge, while at the station the flow, although very small, never ceased entirely.

Discharge Measurements of Maple Creek, near Maple Creek, Sask., in 1908–9.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft per sec.*	*Feet*	*Sec. ft.*
1908.						
May 9	R. J. Burley	.....	.....	.....	0.45	Nil.
May 28	F. T. Fletcher	.....	.....	.....	*0.53	0.05
1909.						
March 29	P. M. Sauder	8.0	9.28	0.88	2.58	8.19†
April 3	....do	32.7	26.9	1.22	2.80	32.8
April 8	F. T. Fletcher	17.5	18.9	0.60	1.56	11.4
April 9	....do	10.5	7.23	1.37	1.30	9.92
April 14	....do	9.5	4.99	1.25	1.20	6.23
April 21	....do	33.0	52.8	1.08	2.65	57.3
May 3	....do	34.0	77.2	1.53	3.55	119
May 4	....do	34.0	99.7	1.62	4.05	162
May 10	H. R. Carscallen	14.0	12.5	1.25	1.62	15.6
May 31	....do	10.0	8.42	0.89	1.235	7.51
June 22	....do	47.8	244	1.47	5.45	347
July 3	....do	23.5	18.9	0.75	1.83	14.2
July 27	....do	1.25	*	0.30	1.29	0.66
August 12	....do	1.25	*	0.06	0.93	0.07
September 11	....do	1.25	*	0.025	0.59	0.02
November 8	....do	1.25	*	0.022	0.84	0.01

*Weir measurements. †Ice conditions.

DAILY Gauge Height, in feet, of Maple Creek, near Maple Creek, Sask., for 1908.

Day.	May.	June.	July.	August.	September	October.
1	.....	0.45	0.5	*	*	*
2	.....	0.45	0.45	*	*	*
3	.....	0.45	0.45	*	*	*
4	.....	0.4	0.4	*	*	*
5	.....	0.45	0.5	*	*	*
6	.....	0.5	0.5	*	*	*
7	.....	0.5	0.45	*	*	*
8	.....	0.5	0.4	0.1	*	*
9	.....	0.5	0.3	*	*	*
10	.....	0.45	0.2	*	*	*
11	.....	0.5	*	*	*	*
12	.....	0.55	*	0.1	*	*
13	0.45	0.55	*	*	*	*
14	0.5	0.55	*	*	*	*
15	0.5	0.5	*	*	*	*
16	0.75	0.5	0.45	*	*	*
17	0.65	0.5	0.45	*	*	*
18	0.5	0.45	0.3	*	*	*
19	0.5	0.45	0.1	*	*	*
20	0.4	0.45	*	*	*	*
21	0.4	0.45	*	*	*	*
22	0.4	0.45	*	*	*	*
23	0.4	0.45	*	*	*	*
24	0.4	0.45	*	*	*	*
25	0.65	0.6	*	*	*	*
26	0.65	0.65	*	0.2	*	*
27	0.6	0.65	*	0.2	*	*
28	0.5	0.65	*	0.2	*	*
29	0.5	0.6	*	0.2	*	*
30	0.5	0.5	*	*	*	*
31	0.5	.....	*	*	.....	*

*Creek dry.

DAILY Gauge Height and Discharge of Maple Creek, near Maple Creek, Sask., for 1909.

Day. Day.	March.		April.		May.		June.	
	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft*
1	.....	.....	†† 2.4	13.6	1.4	10.3	1.2	6.6
2	.....	.....	3.2	46.7	1.5	12.5	1.1	5.2
3	.....	.....	3.0	41.4	3.5	115.5	1.1	5.2
4	.....	.....	2.7	30.8	4.2	176.4	1.0	4
5	.....	.....	2.6	30	3.7	131.8	1.0	4
6	.....	.....	2.5	30.6	2.2	35.4	1.0	4
7	.....	.....	1.85	14.2	1.9	24	1.1	5.2
8	.....	.....	1.6	12.1	1.7	17.7	1.2	6.6
9	.....	.....	1.8	23.4	1.7	17.7	1.2	6.6
10	.....	.....	3.6	126.6	1.6	15	1.0	4
11	.....	.....	2.0	30	1.7	17.7	1.0	4
12	.....	.....	1.75	20.3	2.1	31.3	1.0	4
13	.....	.....	1.8	20.6	1.9	24	0.9	2.9
14	.....	.....	1.6	15	1.7	17.7	0.9	2.9
15	.....	.....	1.2	6.6	1.6	15	1.2	6.6
16	.....	.....	1.12	5.5	1.6	15	1.0	4
17	.....	.....	2,0	27.5	1.6	15	1.0	4
18	.....	.....	2.2	35.4	2.2	35.4	1.0	4
19	.....	.....	2.71	61	2.4	44.5	1.7	17.7
20	.....	.....	3.2	92.9	2.1	31.3	*	.....
21	.....	.....	2.71	61	1.8	20.7	*	†
22	.....	.....	1.89	23.8	1.7	17.7	4.8	249
23	.....	.....	1.6	15	3.9	148.6	3.6	111.2
24	.....	.....	1.7	17.7	3.0	79	2.7	51.7
25	.....	.....	2.4	44.5	2.2	35.4	2.4	36.6
26	.....	.....	3.3	100.2	1.9	24	2.4	36.6
27	.....	.....	2.55	52.1	1.6	15	2.5	41.4
28	.....	.....	2.0	27.5	1.5	12.5	3.0	69.3
29	2.56	8.2	1.7	17.7	1.5	12.5	3.0	69.3
30	2.5	10.1	1.6	15	1.3	8.3	2.4	36.6
31	2.21	7.2	.....	.....	1.25	7.4	.....	.....

*No gauge height observation.

†Creek overflowed its banks. Maximum gauge height 8.8 feet.

††Gauge heights for the month of April are not the mean. Owing to mild days and cold nights the stream was somewhat higher in the evening, when the observations were made, than in the morning.

DAILY Gauge Height and Discharge of Maple Creek, near Maple Creek, Sask., for 1909. —*Concluded.*

Day.	July.		August.		September.		October.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.4	36.6	1.3	0.8	0.8	0.04	0.7	0.03
2	2.3	32.1	1.2	0.4	0.7	0.03	0.7	0.03
3	1.8	13.1	1.2	0.4	0.7	0.03	0.7	0.03
4	1.8	13.1	1.2	0.4	0.7	0.03	0.7	0.03
5	1.8	13.1	1.1	0.2	0.7	0.03	0.7	0.03
6	1.8	13.1	1.1	0.2	0.7	0.03	0.7	0.03
7	1.9	16.5	1.1	0.2	0.6	0.02	0.7	0.03
8	1.8	13.1	1.0	0.1	0.6	0.02	0.7	0.03
9	1.6	7	1.0	0.1	0.6	0.02	0.6	0.02
10	1.6	7	1.0	0.1	0.6	0.02	0.6	0.02
11	1.8	13.1	1.0	0.1	0.6	0.02	0.6	0.02
12	2.3	32.1	0.9	0.06	0.7	0.03	0.6	0.02
13	2.3	32.1	0.9	0.06	0.7	0.03	0.6	0.02
14	2.3	32.1	0.9	0.06	0.7	0.03	0.6	0.02
15	2.4	36.6	0.9	0.06	0.7	0.03	0.6	0.02
16	2.4	36.6	0.8	0.04	0.7	0.03	0.7	0.03
17	2.5	41.4	0.8	0.04	0.7	0.03	0.7	0.03
18	1.6	7	0.8	0.04	0.8	0.04	0.7	0.03
19	1.6	7	0.8	0.04	0.8	0.04	0.8	0.04
20	1.6	7	0.8	0.04	0.8	0.04	0.8	0.04
21	1.5	4.3	0.8	0.04	0.8	0.04	0.9	0.06
22	1.4	2.2	0.8	0.04	0.8	0.04	0.9	0.06
23	1.3	0.8	0.8	0.04	0.8	0.04	0.8	0.04
24	1.3	0.8	0.8	0.04	0.8	0.04	0.8	0.04
25	1.3	0.8	0.8	0.04	0.8	0.04	0.8	0.04
26	1.2	0.4	0.8	0.04	0.7	0.03	0.8	0.04
27	1.3	0.8	0.8	0.04	0.7	0.03	0.8	0.04
28	1.4	2.2	0.8	0.04	0.7	0.03	0.8	0.04
29	1.3	0.8	0.8	0.04	0.7	0.03	0.8	0.04
30	1.5	4.3	0.8	0.04	0.7	0.03	0.8	0.04
31	1.4	2.2	0.8	0.04	.....	.....	0.8	0.04

MONTHLY Discharge of Maple Creek, near Maple Creek, Sask., for 1909.

[Drainage area, 91 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
March (29-31)	10.1	7.2	8.5	.093	.010	51.
April	126.6	5.5	35.3	.388	.433	2,100.
May	176.4	7.4	38.2	.420	.484	2,349.
June (1-19—22-30)	249	2.9	28.7	.315	.328	1,593.
July	41.4	0.4	13.8	.152	.175	852.
August	0.8	0.04	0.12	.0014	.0016	7.7
September	0.04	0.02	0.03	.0003	.0003	1.8
October	0.04	0.02	0.03	.0004	.0005	2.
The period	.....	.....	.....	.....	.....	6,956

NOTE.—June 20 and 21, flood period, not included.

GAP CREEK AT SMALL'S RANCHE.

This station was established April 25, 1909 by F. T. Fletcher. It is located on Section 3, Tp. 10, Range 27, West of the 3rd Meridian, about four hundred yards west of the surveyed trail from Maple Creek to Tenmile and about twelve miles south of Maple Creek.

The channel is straight for 600 feet above and below the station. The right bank is high and will not overflow except at very extreme floods stages; the left bank is much higher than the right and will not overflow at any stage of the stream. The bed of the stream is composed of loose, coarse gravel. The current is sluggish.

The gauge, which is read daily by Wm. Small, is a plain rod, graduated to feet and hundredths, spiked firmly to a vertical post sunk in the bed of the stream at the right bank and securely stayed to the bank. The gauge is referred to bench marks as follows: (1) The top of the initial point stake on the right bank, marked B. M.; elevation, 8.08 feet above gauge zero. (2) The top of the final point stake, driven close to the ground on the left bank and marked B. M.; elevation, 8.09 feet above the zero of the gauge. (3) Nail-heads on top of the ground-log at the southwest corner of a cow shed, just below the cross-section and on the right bank; elevation, 9.60 feet above gauge zero.

Discharge measurements are made at the regular station by wading and at very low stages a weir is used. The regular station is a cross-section taken 250 feet above the gauge and the initial and final point stakes are located on the right and left banks of the stream, respectively, at this cross-section. The initial point for soundings is a square stake driven close to the ground on the right bank and marked B. M.

DISCHARGE Measurements of Gap Creek at Small's Ranche in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
		Feet.	*Sq. ft.*	*Ft. per sec.*	*Feet.*	*Sec.-ft.*
March 30	P. M. Sauder	7.5	3.58	2.86	.....	10.2
April 23	F. T. Fletcher	29.0	27.3	0.80	2.46	21.9
May 4	do	43.2	51.8	3.07	3.19	159
May 29	H. R. Carscallen	25.0	14.8	0.40	2.22	5.94
July 2	do	26.0	29.1	0.32	2.31	9.36
July 23	do	1.25	*	0.315	2.10	0.70
August 10	do	1.25	*	0.051	2.00	0.05
September 10	do	.....	.....	.....	1.70	Nil.†
September 30	do	.....	.....	.....	1.83	Nil.†
November 6	do	.....	.....	.....	1.94	Nil.†

*Weir measurements.

†Flow is practically zero, although a spring breaks out about 250 feet above the gauge and has a very small discharge (too small to measure satisfactorily.)

DAILY Gauge Height and Discharge of Gap Creek, at Small's Ranche, for 1909.

Day.	April.		May.		June.		July.	
	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	2.3	9	2.1	0.7	2.5	26.2
2	.....	.....	2.5	26.2	2.1	0.7	2.35	12.7
3	.....	.....	3.0	113	2.1	0.7	2.3	9
4	.....	.....	3.1	136.7	2.1	0.7	2.3	9
5	.....	.....	3.0	113	2.1	0.7	2.3	9
6	.....	.....	2.5	26.2	2.1	0.7	2.3	9
7	.....	.....	2.4	16.4	2.1	0.7	2.3	9
8	.....	.....	2.35	12.7	2.05	0.4	2.3	9
9	.....	.....	2.3	9	2.2	3.9	2.25	6.4
10	.....	.....	2.4	16.4	2.15	2.3	2.25	6.4
11	.....	.....	2.45	21.3	2.1	0.7	2.2	3.9
12	.....	.....	2.5	26.2	2.1	0.7	2.2	3.9
13	.....	.....	2.5	26.2	2.1	0.7	2.25	6.4
14	.....	.....	2.5	26.2	2.1	0.7	2.3	9
15	.....	.....	2.5	26.2	2.1	0.7	2.25	6.4
16	.....	.....	2.45	21.3	2.1	0.7	2.2	3.9
17	.....	.....	3.43	222.6	2.3	9	2.2	3.9
18	.....	.....	3.4	214.3	2.5	26.2	2.2	3.9
19	.....	.....	2.9	90.8	2.8	71	2.15	2.3
20	.....	.....	2.5	26.2	5.3	†	2.15	2.3
21	.....	.....	2.4	16.4	6.5	†	2.1	0.7
22	.....	.....	2.4	16.4	3.1	136.7	2.1	0.7
23	.....	.....	3.72	304.7	2.8	71	2.1	0.7
24	2.5	26.2	2.6	38.7	2.8	71	2.1	0.7
25	3.0	113	2.4	16.4	2.8	71	2.1	0.7
26	3.2	162	2.35	12.7	2.8	71	2.1	0.7
27	2.65	46.1	2.3	9	2.7	53.6	2.1	0.7
28	2.55	32.5	2.25	6.4	2.6	38.7	2.1	0.7
29	2.4	16.4	2.2	3.9	3.0	113	2.6	38.7
30	2.25	6.4	2.2	3.9	2.9	90.8	2.4	16.4
31	.....	.....	2.15	2.3	.....	.....	2.3	9

†Data for computation of discharges insufficient.
Maximum gauge height in the June flood of 1909, was 8.8 feet and occurred on June 21

DAILY Gauge Height and Discharge of Gap Creek, at Small's Ranche, for 1909—*Con.*

Day.	August.		September.		October.	
	Gauge. height.	Dis-charge.	Gauge height.	Dis-charge.	Gauge height.	Dis-charge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.ft-.*	*Feet.*	*Sec.-ft.*
1	2.25	6.4	1.8	*	1.8	*
2	2.25	6.4	1.8	*	1.8	*
3	2.2	3.9	1.8	*	1.8	*
4	2.15	2.3	1.8	*	1.8	*
5	2.1	0.7	1.8	*	1.8	*
6	2.1	0.7	1.8	*	1.8	*
7	2.05	0.4	1.8	*	1.8	*
8	2.05	0.4	1.8	*	1.8	*
9	2.0	0.05	1.8	*	1.8	*
10	2.0	0.05	1.8	*	1.8	*
11	2.0	0.05	1.8	*	1.9	0.02
12	2.0	0.05	1.8	*	1.9	0.02
13	2.0	0.05	1.8	*	1.9	0.02
14	2.0	0.05	1.8	*	1.9	0.02
15	2.0	0.05	1.8	*	1.9	0.02
16	2.0	0.05	1.8	*	1.9	0.02
17	1.95	0.04	1.8	*	1.9	0.02
18	1.95	0.03	1.8	*	1.9	0.02
19	1.9	0.02	1.8	*	1.9	0.02
20	1.9	0.02	1.8	*	1.9	0.02
21	1.9	0.02	1.8	*	1.9	0.02
22	1.9	0.02	1.8	*	1.9	0.02
23	1.9	0.02	1.8	*	1.9	0.02
24	1.9	0.02	1.8	*	1.9	0.02
25	1.9	0.02	1.8	*	1.9	0.02
26	1.9	0.02	1.8	*	1.9	0.02
26	1.9	0.02	1.8	*	1.9	0.02
27	1.9	0.02	1.8	*	1.9	0.02
28	1.85	0.01	1.8	*	1.9	0.02
29	1.85	0.01	1.8	*	1.9	0.02
30	1.8	*	1.8	*	1.9	0.02
31	1.8	*	.....	.....	1.9	0.02

*No flow in stream, water standing in pools, August 30—October10.

MONTHLY Discharge of Gap Creek at Small's Ranche, for 1909.

[Drainage area, 69.5 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
April (24-30)	162	6.4	57.5	.828	.216	799
May	305	2.3	51.9	.748	.862	3,195
June (1-19—22-30)	137	0.4	29.9	.431	.449	1,663
July	38.7	0.7	7.14	.103	.119	439
August	6.4	0.0	0.71	.0102	.012	43.3
September	0.0	0.0	0.0	.000	.000	0
October	0.02	0.0	0.01	.0002	.0002	0.8
The period	.....	.....	.....	.....	.....	6,140

NOTE.—June 20 and 21, the flood period, not included.

McSHANE CREEK AT SMALL'S RANCHE.

This station was established April 23, 1909 by F. T. Fletcher. It is located on Section 4, Tp. 10, Range 27, West of the 3rd Meridian, at the highway bridge on the surveyed trail from Maple Creek to Tenmile, about twelve miles south of Maple Creek. The station is about 600 feet above the mouth of the creek and about 500 feet from Wm. Small's house. Mr. Small diverts water from the stream for irrigation purposes and as the intake of his ditch is above the station, records of daily flow do not represent the full discharge of the creek when water is being used in the ditch.

The channel is straight for 100 feet above and 200 feet below the station. Both banks are high and not liable to overflow. The bed of the stream is composed of coarse gravel and shifts at high stages. The current is swift.

The gauge, which is read daily by Mr. Small, is a plain rod, graduated to feet and hundredths, attached firmly to the right abutment on the downstream side of the bridge. The gauge is referred to bench marks as follows: (1) Nail-heads in the top of the wooden stringer at the north or right side of the stream and on the downstream side of the bridge, marked B.M. with white paint; elevation, 9.68 feet above the zero of the gauge. (2) The top of the iron pin in the road mound situated 350 feet south of the bridge on the east side of the trail; elevation, 16.96 feet above the zero of the gauge.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is the inner face of the right abutment of the bridge. Low-water measurements are made near the gauge by wading and at very low stages a weir is used.

Discharge Measurements of McShane Creek at Small's Ranche, in 1909.

Date.	Hydrographer.	Width.	Area of section.	Mean velocity.	Gauge height.	Discharge.
April 23	F. T. Fletcher	7.5	1.69	0.87	0.51	1.47
May 4	....do	11.0	4.52	2.51	0.82	11.3
May 29	H. R. Carscallen	4.0	1.18	0.77	0.92	0.91
June 17	....do	6.8	7.91	0.69	1.03	5.48
July 2	....do	2.5	0.78	0.31	0.48	0.24
July 23	....do	.....	.....	.....	.....	Nil.*
August 10	....do	.....	.....	.....	.....	Nil.*
September 10	....do	.....	.....	.....	.....	Nil.*
September 30	....do	.....	.....	.....	.....	Nil.*
November 6	....do	.....	.....	.....	.....	Nil.*

*Creek dry.

Daily Gauge Height and Discharge of McShane Creek, at Small's Ranche, for 1909.

Day.	April.		May.		June.		July.	
	Gauge Height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.	Gauge height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	.....	.....	0.5	1.35	0.7	0.0	0.7	1.25
2	.....	.....	0.6	3.4	*	.....	0.5	0.35
3	.....	.....	0.8	10.4	*	.....	0.5	0.35
4	.....	.....	0.8	10.4	*	.....	0.5	0.35
5	.....	.....	0.9	15	*	.....	0.5	0.35
6	.....	.....	0.5	1.35	*	.....	0.6	0.7
7	.....	.....	0.5	1.35	*	.....	0.6	0.7
8	.....	.....	0.5	1.35	*	.....	0.5	0.35
9	.....	.....	0.5	1.35	1.0	4.05	0.3	0.0
10	.....	.....	0.6	3.4	1.0	4.05	*	.....
11	.....	.....	0.6	3.4	0.9	0.6	*	.....
12	.....	.....	0.6	3.4	0.9	0.6	*	.....
13	.....	.....	0.5	1.35	0.8	0.1	0.9	3.15
14	.....	.....	0.5	1.35	0.7	0.0	0.6	0.7
15	.....	.....	0.5	1.35	05	0.0	0.5	0.35
16	.....	.....	0.5	1.35	*	.....	*	.....
17	.....	.....	0.85	12.7	1.05	5.9	*	.....
18	.....	.....	0.82	11.3	1.45	20	*	.....
19	.....	.....	0.6	3.4	1.8	38	*	.....
20	.....	.....	0.5	1.35	4.5†	.....	*	.....
21	.....	.....	0.5	1.35	1.9	44.3	*	.....
22	.....	.....	0.5	1.35	1.0	4.8	*	.....
23	.....	.....	1.6	50	0.9	3.15	*	.....
24	0.5	1.35	1.0	13.4	0.8	2	*	.....
25	0.8	10.4	1.0	10.4	0.9	3.15	*	.....
26	0.7	6.4	0.9	4.1	0.8	2	*	.....
27	0.5	1.35	0.9	2.5	0.8	2	*	.....
28	0.6	3.4	0.9	1.4	0.7	1.25	*	.....
29	0.4	0.4	0.9	0.75	0.7	1.25	0.7	1.25
30	0.5	1.35	0.8	0.1	0.7	1.25	0.4	0.1
31	.....	.....	0.8	0.1	.....	.....	0.2	0.0

*Creek dry June 2–8, July 10–12, July 16–28 and August 1—October 31.
†Data for computation of discharge insufficient.
‡Discharges for all gauge heights above 1.05 feet are computed discharges.
aSmall stream in Wm. Small's ditch during month of May.

Miscellaneous Measurements.

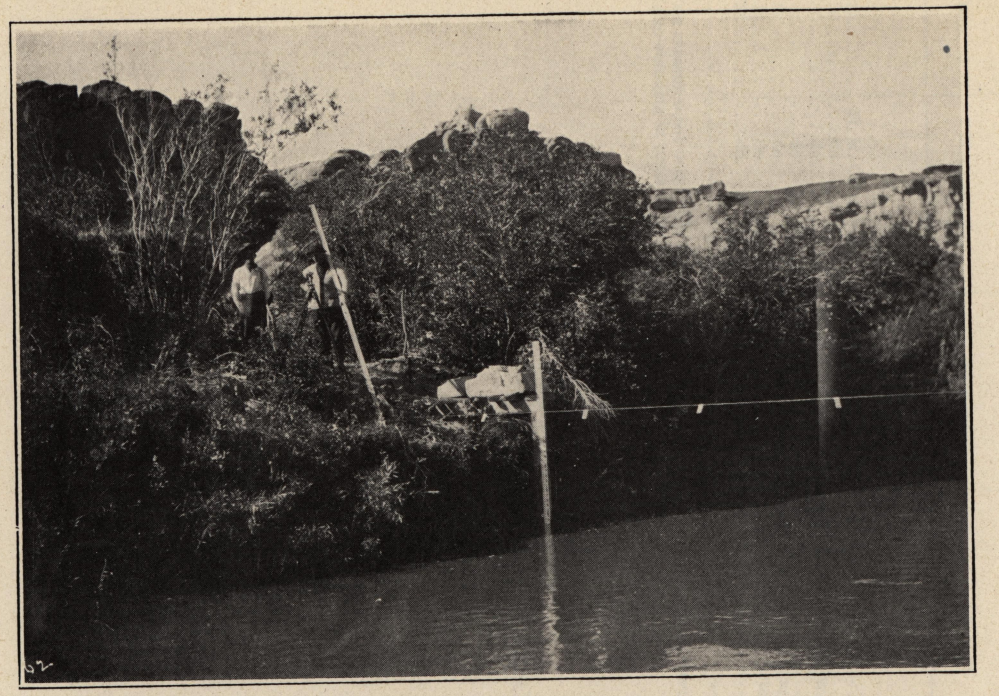
Miscellaneous Discharge Measurements in the vicinity of Walsh, Irvine and Medicine Hat, in 1909.

Date.	Hydrographer.	Stream.	Locality.	Discharge.
				Sec.-ft.
August 30	H. R. Carscallen	Boxelder Creek	Sec. 2-12-30-3	Nil.
August 30	....do	Stony Creek	Sec. 25-11-2-4	Nil.
August 30	....do	Mackay Creek	Sec. 26-11-1-4, near Walsh	Nil.†
August 31	....do	Ross Creek	At Irvine	*0.025
August 31	....do	Bullshead Creek	Traffic bridge, near Dunmore Jct.	Nil.
August 31	....do	Gros Ventre Creek	Traffic bridge at Norton	Nil.
August 31	....do	Seven persons River	At Medicine Hat	Nil.

*Weir measurement below C.P. Railway dam. Discharge obtained is merely the seepage through the dam.
†Water standing in pools in the creek bed.

Respectfully submitted,

H. R. CARSCALLEN.



Gauge Rod at Writing-on-Stone.

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REPORT

ON

THE MILK RIVER, ALBERTA

SUBMITTED TO

THE CHIEF HYDROGRAPHER, DEPARTMENT OF INTERIOR

BY

F. H. PETERS, C.E., District Hydrographer.

JANUARY 14TH, 1910.

To the Chief Hydrographer,
Department of the Interior,
Calgary, Alta.

SIR,—I have the honour to submit herewith my report of the work done by the party under my charge on the Milk River, Alberta, during the summer of 1909.

I have the honour to be, Sir,
Your obedient servant,
F. H. PETERS.

OTTAWA, January 14, 1910.

REPORT ON MILK RIVER.

GENERAL DESCRIPTION.

The Milk River rises on the eastern slope of the foothills in the Blackfeet Indian Reserve in the United States. Its headwaters run down in two main streams which are known, after entering Canada, as the north and south branches. The north branch runs in a north-easterly direction through the Blackfeet Reserve for a distance of about 15 miles and then enters Canada near the south-east corner of the south-west quarter of Section 3, Township 1, Range 23, West of 4th Meridian. From the international boundary the stream continues in a north-easterly direction for about nine miles when it bends to the east and runs in an easterly direction through the second tier of townships to its junction with the south branch at the south-west corner of the north-east quarter of Section 20, Township 2, Range 18, West of the 4th Meridian.

The south branch runs to the south and east of, and parallels the north branch for a distance of about 48 miles, as the crow flies, through the Blackfeet Reserve and then enters Canada near the south-east corner of the south-west quarter of Section 1, Township 1, Range 20, West of the 4th Meridian. From the international boundary it runs in a north-easterly direction to its junction with the north branch. From the junction of the two branches the Milk River runs in an easterly direction through the second tier of townships in Canada to the east boundary of range 7. From this point the river runs in a south-easterly direction to its first point of crossing the international boundary into the United States. This first point of crossing is near the south-west corner of the south-east quarter of section 5, Township 1, Range 5, west of the 4th Meridian. The river runs for a distance of about 1,540 feet (mid-stream measurement) through the Uuited States, then crosses back into Canada and runs in an easterly direction about one quarter of a mile north of the international boundary to a point near the south-west corner of the south-east quarter of Section 3, Township 1, Range 5, West of the 4th Meridian where it crosses again into the United States. The river runs for a distance of about 2,440 feet (mid-stream measurement) through the United States and then crosses back into Canada. From this point the river meanders in an easterly direction through Canada to a point on the international boundary about 900 feet west of the east boundary of Section 1, Township 1, Range 5, West of the 4th Meridian where it finally crosses into the United States. This point is known as the "Eastern Crossing." The length of the course of Milk River in Canada from the western crossing of th north branch to the eastern crossing is 179 miles. The length of the course of the south Branch in Canada is 20 miles.

(To follow the description above, refer to plates 1 and 2

Gauge Rod on the North Branch at Mackie's Ranche.

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Character of River Valley.

Throughout its course in Canada from the western crossing of the north branch to the eastern crossing the Milk River runs through a well defined valley bordered on each side by a range of hills. The whole of its water-shed in Canada is bald prairie land. The river receives a number of small tributary creeks along its course all of which discharge a considerable volume of water during the spring freshets; they all dry up by July 1, (about) and have no considerable discharge again until late in the fall when some of them have a small flow for perhaps a month before the freeze up. The same remarks apply to the south branch in its course through Canada.

The general conditions of flow in the river are such as are typical of all rivers which have a watershed devoid of tree growth; that is it is subject to extreme floods during the freshet period and to correspondingly low flow during the summer months. From its headwaters to the eastern crossing the total area of the watershed of Milk River is 2,448 square miles. Of this total amount 1,645 square miles are in Canada and 803 square miles in the United States.

(Refer to table B.)

Personnel and Equipment of Party.

The party consisted of one engineer in charge, one assistant, one teamster and a cook. The party was equipped with a camping outfit which included one heavy team and Bain wag on, one driving team and democrat and a saddle pony. The party worked from Milk River station as a base. The instrumental equipment of the party included:

Draughting instruments.
One pocket sextant.
One Y level (Gurley's 14″ with compass)..
One large Price electric meter.
One small Price electric meter.
One stop watch—cutting to 1-5 second.
One Price acoustic meter.

Instructions regarding work required.

The instructions given to the engineer in charge were to the effect that the work required of the party was to make complete stream measurements covering the whole of the Milk River in Canada for the whole season and also to prepare permanent stations along the river so that records could be made in succeeding seasons covering all stages of flow. In addition to this it was desirable that a reconnaissance be made of the tributaries of Milk River as far east as Battle Creek.

The conditions to be confronted were these. The whole territory to be covered meant a distance to be travelled by trail of 214 miles from end to end. The distance by trail to cover the Milk River alone is about 150 miles and throughout all of this territory no definite information was available as to where gauging stations could be developed so that it was necessary to first of all make a reconnaissance trip over the whole territory, and it was also realized that to get complete discharge measurements on the Milk River, at sufficiently close intervals, would mean that the party would have to do nothing but travel continuously up and down the river and this would leave no time for the construction of permanent stations.

After due consideration of all these points it was decided that the best policy to adopt, for the best ultimate results, was one which would ensure the river being properly prepared for complete measurements in the future, and at the same time get as many stream measurements as possible during the season.

Work done by the party.

The party was organized by the Chief Hydrographer at Lethbridge and commenced work in the field at Milk River station on July 1, 1909.

From July 1 to August 27, the party made a reconnaissance trip covering all the territory from Peter's ranche to Spencer's lower ranche and on the Battle Creek. (Refer to plates 1 and 2.) During this time nine days were spent driving with a light outfit in the democrat making special trips to get discharge measurements and four days the party were idle owing to heavy rains.

From August 28 to October 28, the party was engaged erecting permanent stations from Peter's ranche to Spencer's lower ranche. (Refer to plate 1 and table A.)

On October 30, the engineer in charge returned to Calgary and the assistant from October 31 to November 15, made a flying trip in the democrat taking discharge measurements from Peter's ranche to Spencer's lower ranche.

Total time of party in the field 138 days. During this time 49 stream measurements were made and 7 permanent gauging stations were erected.

Reconnaissance Trip.

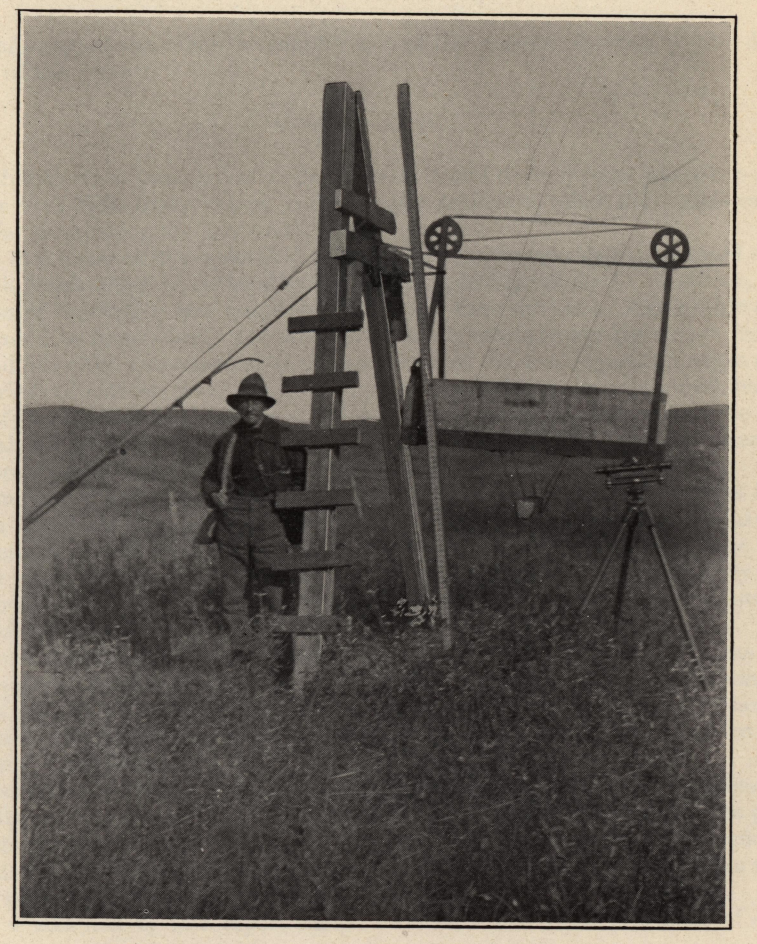
The object aimed at on this part of the work was to make a careful study of the Milk River and pick out sections which were suitable for making immediate stream measurements and which were also suitable for establishing permanent stations. Cross-sections of the river throughout its whole length in Canada, all have the same controlling elements. They all have one high bank and one low; they are all liable to overflow at flood and the soil is sandy loam or gravel. There are very few settlers along the river who live close to it so that great difficulty was experienced in finding gauge readers, and in picking out the locations for the several stations the main point which had to be considered was to find a place where a permanent gauge reader could be relied upon. Another difficulty encountered was to erect gauge rods which would not be liable to destruction by the ice, the spring floods, or by the river cutting away the bank against which they were placed. The type of gauge rod support adopted was as follows: A strong upright varying from 6 to 12 feet in length was sunk in the bed of the stream to a solid footing. This upright was secured in place by two strong braces nailed to it near the top, and triangling off and nailed to, two solid posts sunk four feet deep in the bank. Across these supports a platform was laid and the whole well weighted down with large stones or with bags of sand where stones were not procurable. To one face of the upright the gauge rod was securely nailed with 6 inch spikes. The standard form of gauge rod used was a wood staff graduated to one-hundredths of a foot and showing 10 feet. (See plates 21 and 22.)

After the location of the station had been decided on the procedure was as follows: Two posts were sunk, one on each side of the river, and between these a "low water" measuring wire was stretched for use in metering by the wading method. This wire was graduated to 5 feet and every 10 feet marked by a tin hanger. The zero distance of the section was usually taken on the left hand side of the stream and was always marked by a cedar post solidly sunk in the ground and marked accordingly. At some convenient place—usually on the line of the section—a large cedar post was sunk to such a depth that it would not be disturbed by frost. This was cut off leaving only about 10 inches above the ground so as not to be disturbed by cattle, and on it a bench mark was made. The gauge rod was then erected and its zero referred to the B.M. by very careful levelling.

The cross-section at the station was then carefully developed with the level for use in designing the structures for a permanent station. In this connection evidences of extreme high water were always carefully searched for and their elevations noted.

During this part of the work a general reconnaissance of all the country travelled through was made, particular attention being paid to finding the shortest routes by trail between stations, and this information is shown graphically with distances tabulated on plate 2 attached to this report. The class of the various trails is shown by the legend on this plate,

PLATE No. 23.



Type of Support use at Peter's Ranche.

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but two points must be kept in mind in formulating any plan for covering this territory with hydrographers for making stream measurements. During the dry season the trails are all fairly hard and easy to travel over but they run through a clay soil for the most part and therefore in the spring they are very soft and hard to travel over. At all the points where the trails shown cross the river, good low water fords exist, but these fords must be approached with caution during periods of high water and are impassable during periods of extreme flood. These points are of importance because the several stations must be visited at short intervals during periods of high water, and it is during this time that the trails are all hard to travel over while some of them are barred altogether on account of the fords being impassable.

The information regarding the country east of the eastern crossing will be discussed at the end of this report.

Construction Trip.

The Milk River in Canada has no dams across it, and the only point where it is spanned by a bridge is at Milk River station, so it was early decided to adopt the "cable car" type of Station for establishing the permanent gauging stations.

In the first instance it was decided to erect these stations so that they would span the whole width which might be covered by the stream at its highest flood. However, after an examination of the river it was found that the banks were subject to such a wide overflow that this would be impossible. The stations as finally erected span the stream from bank to bank and allow the measurement of the main bulk of the discharge at all stages of flood. During periods of extreme flood the cable supports are liable to be submerged, but as the duration of these floods is short the actual amount of water passing around the stations will be small and in many cases is impossible of accurate measurement by any means owing to scrub, brush and other obstructions.

In some cases one support was liable to such deep submersion that it was liable to destruction by flood. In such cases the support was placed where it would have some natural protection (such as in a clump of trees) or when it was necessary to place it where the current would have a clear sweep, the base of the support was well protected by a riprap of large stones. At every station a meter stay-line wire was stretched 30 feet upstream for use in flood measurements.

The main timbers used at all stations were of dimensions 6x6 inches. It was realized that for supports of a height of 20 feet or more these were rather light, but, owing to the difficulty of obtaining any material of larger dimensions and also to the great distances and bad roads over which the materials had to be hauled, they were adopted as the most suitable under existing conditions.

The conditions existing at Spencer's lower ranche (near the eastern crossing) are typical of those existing on the river. Plate 3 attached to this report show the principal details of the permanent station erected at this point, and the same details are typical of all the cable stations except the low station erected at Peter's ranche. At this station the form of support is somewhat modified as can be seen by referring to Plate 23.

Plate 4 attached to this report shows the details of the standard form of cable car adopted.

(Refer to Table A attached to this report for list of permanent stations.)

(Refer to Plates 23, 24, 25, 26, 27.)

Method of Stream Measurements.

All the discharge measurements made during the season were made by the "one point method." That is, at each distance of the cross-section the velocity was measured at a depth equal to 0.6 of the measured depth and this velocity was taken as representing the mean velocity of the water in that vertical. The large Price electric meter was considered

the most reliable instrument and was used for all measurements where the depth of water was sufficient to allow of its immersion. For the shallower cross sections the small Price electric meter was used. At some of the wading stations which were chosen at the beginning of the season, the velocity of the current later in the season became too slow to allow of accurate measurement. The rule followed in such cases was as follows:—When the mean velocity at the section fell below 0.5 feet per second the section was abandoned and a new one located at the nearest place where the current had a suitable velocity. The great majority of the stream measurements were made by the wading method, and in a few cases where the depth of water was too great they were made by the use of a collapsible canvas boat. The usual procedure was to immerse the meter at both edges of the stream and at intervals of 5 feet across the stream.

Compilation of Data.

The accuracy of the data computed from the field measurements is affected by the following conditions:—

(i) The gaugings at each station were not frequent enough.

(ii) The gauge rods in some cases were not read closely enough by the gauge readers.

(iii) The inability to check the meter ratings.

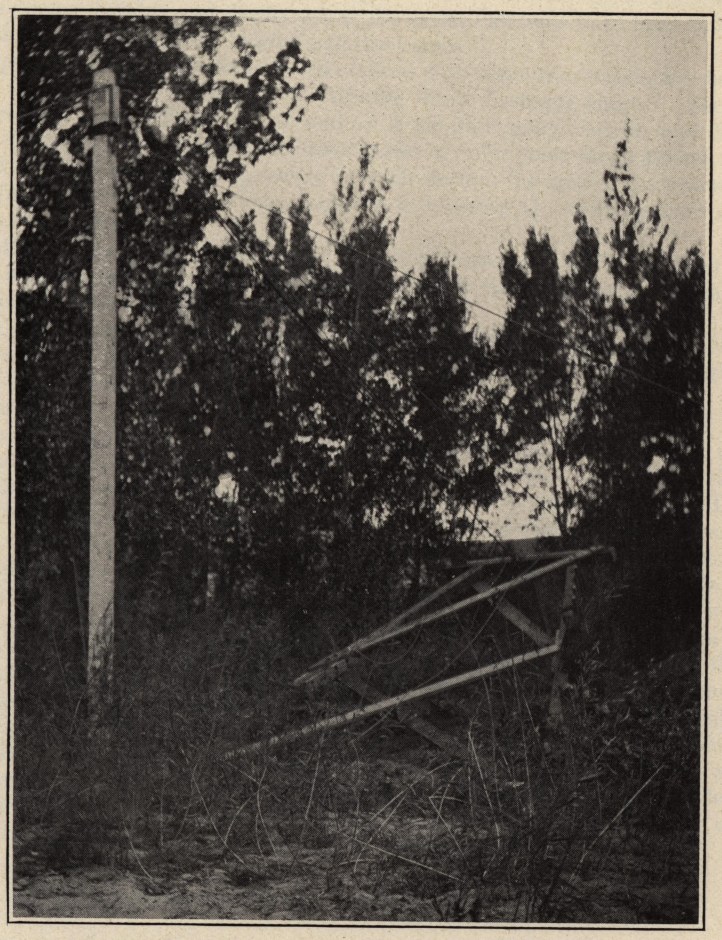
(i) It has been noted in the first part of this report the conditions which made it impossible for the party to devote all their time to stream measurements. The gaugings at each station were made frequently enough to cover all considerable changes in gauge height and therefore theoretically they should have been sufficient to develop a good station rating curve for the range of gauge heights which they covered, but it was found that all the sections, particularly from Milk River eastwards, had shifting bottoms, and even during periods when the gauge height was stationary or changing very slowly the river was found to have a continually shifting bottom. This condition necessitates the shifting of the station rating curve to meet the varying conditions of the river bottom, and owing to the considerable changes which took place in the river bottom between gaugings it was sometimes difficult to know how to manipulate the curve correctly. The manipulation of the station rating curves, made necessary on this account, was performed by the "Bolster method" and although much thought and care was bestowed on this part of the work the gaugings were not frequent enough to ensure great accuracy.

Plate 5 attached to this report shows the changes which took place in the river bottom at the sections used at Milk River from May 18 to October 5, 1909, and also the necessary manipulation of the station rating curve to cover the same period. The conditions at this station are typical of those existing on the whole course of the river.

(ii.) The standard type of gauge rod inslalled was graduated to one-hundredths of a foot. In some cases the gauge readers employed were men of little or no education and it was found very difficult to instruct these men to read the gauge rod to hundredths correctly. These men would gradually drift into the habit of reading the gauge rod to the nearest tenth or perhaps half-tenth, which made the gauge heights recorded by them liable to an error up to the 5-100ths of a foot. The hydrographer, when visiting stations frequently noticed these discrepancies on reading the gauge to hundredths. At these stations where the gauge rod was read only to tenths the station rating curve was constructed by plotting gauge heights only to the nearest tenth because this method minimizes the error in discharges taken from the curve corresponding to gauge heights read only to the nearest tenth.

(iii) The meters used during the seasons were new (supplied by W. & L. E. Gurley of Troy, N.Y.), and had the usual rating tables attached to them, which were used for computing discharges. These rating tables are not the ratings of the actual meters themselves but are the mean of many ratings of the same type of meter. It has been found in practice that these rating tables can be relied upon so that their use in the first instance was justifiable. It is also found in practice that a new meter, provided it has careful handling and is well supplied with new points, usually does not change its rating until it has had considerable use.

PLATE NO. 24.



Left Frame, at Spencer's Lower Ranche, ready to hoist.
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However the action of a current meter cannot be relied upon and it is highly desirable and the usual practice to rate every meter periodically in order to make sure that its rating is correct. During the past season there was no opportunity to rate the meters used so that the rating tables mentioned above were used for computing discharges all through the season without any check on their accuracy.

All the information collected during the season regarding stream measurements has been compiled in the following form: All the discharge measurements made at the several stations have been tabulated on sheets headed "discharge measurements at regular stations".

The daily gauge heights and discharges at the several stations have been tabulated on sheets headed "daily mean gauge heights and discharges."

For the purpose of comparison between stations this same information has been again tabulated on sheets headed "Milk River, Alberta, daily discharge sheet." Each one of these sheets cover a period of one month and on it the daily gauge heights and discharges are tabulated for all of the stations on the river taken in order going down stream.

Table B attached to this report shows, for each station, the area of the watershed, the total run-off in acre feet for the period—August 8 to October 31—and also the run-off per square mile for the same period.

This table practically covers the period which is known as the "dry season" and is useful in that it shows the relative contribution to the flow in the river during this season from the different parts of the watershed.

It will be seen on consulting this table that the relative run-off per square mile for that part of the watershed of the north branch above Peter's ranche is extremely high. This is accounted for by the fact that this part of the river is fed by many springs, most of which have a continuous flow all summer. This condition exists in a lesser degree along the river as far down as Knight's ranche. It will also be noticed on consulting Table B. and also the sheets headed "Milk River, Alberta, daily discharge sheet," that the discharge at certain stations is greater than that at the station next below it on the stream. This may be accounted for to some small extent by inaccuracies in the stream measurements, but the large differences shown on these tables are certainly not to be accounted for in this manner. The explanation of these differences (which the writer thinks is the correct one) is that the stream has a large sub-surface flow at some stations while at other stations this flow is brought up into the bed of the stream by underlying impervious strata. Some observations made at Writing on Stone constitute a certain evidence that this condition does exist along the river.

At this station the width of the river channel between banks is about 126 feet and during the summer the actual width of the channel through which the water ran was only about 60 feet. This left a stretch of bare sand on one side of the stream about 60 feet wide and the average elevation of its surface above the water was about 1 foot. Several holes were dug in this stretch of sand and in each one the water was seen to have a quite perceptible motion in the same direction as the stream, proving that there was a considerable flow of water through this stretch of sand which could not be measured at this station.

The effect of turning 1,000 *cu. ft. per second into Milk River.*

In anticipation of the pending Waterways Treaty between the United States and Canada, a short discussion is given of the probable effect of turning 1,000 c.f. per second into the channel of the north branch of the Milk River, whence it would flow down the river channel to the eastern crossing.

The north branch from its western crossing to the junction with the south branch is, during all ordinary stages of flow, a very small stream. Its average summer flow is about 55 cu.ft. per second. Its course through the river valley is exceedingly tortuous and the existing channel is not in any way suited to the carriage of 1,000 cu.ft. per second. If this volume of water was turned into the north branch it would immediately overflow its banks in some places and over the whole course the river would be running with banks practically full and the velocity of the stream would be so high that it would create a very heavy scour. The river banks are everywhere of soft material which is liable to erosion and in a short time

the river channel would adapt itself naturally to the new conditions of flow. This would mean a very decided change in its average cross sectional area and also the river channel would change its course in many places.

The actual change which would take place in the cross section of the river will be better understood from the following: Different rivers flowing through different kinds of country have different characteristic forms of cross section which are directly dependant upon the kind of soil or rock through which they flow, and also upon the slope of the river. Rivers which run through a channel of rock or any kind of hard material, or through clay where the slope is small, have a characteristic cross section in which the depth is great in comparison with the width. The north branch of Milk River running with banks full, would have a cross-section with these characteristics. But from the kind of soil through which the river runs and also from the slope of the river we know that the natural cross section should be one in which the depth is small in comparison with the width. That is to say, the river would gradually widen itself out until it acquired a natural cross-section with a small average depth and great width. This is the character of the cross-section which the river now has below the junction of the north and south branches. From the junction of the north and south branches eastward the conditions would be different because the existing river channel is much wider and the river channel would not have to undergo any great radical change to adapt itself to a continued flow of 1,000 cu.ft. per second. It would, however, have a certain effect on the river channel which may be understood from the following discussion: Over this part of the river, the river channel is continually and slowly changing its course. This is caused by the current cutting out the banks of the river at points where it is thrown against the banks owing to changes in direction of the river's course. This tendency of the river to cut out its banks and shift its course is certainly directly dependant upon the volume of water carried by the stream, and therefore, if an extra 1,000 cu.ft. per second of water is run through this channel it will certainly very much accentuate the tendency of the river to cut out its banks and change its course.

This extra volume of water would not be turned into the stream during periods of flood and therefore would not directly affect the excessive flood discharges which occur annually. However, the passage of this extra volume of water down the stream during the summer months would have an indirect effect upon the overflowing of the banks which occurs annually because, as already stated, it would, particularly on the north branch, have the effect of enlarging the river channel and would therefore to some extent lessen the tendency of the river to overflow its banks at flood periods.

The above remarks will serve to point out the character of the damage which will be done to the river bottom lands of Milk River, but further than this it is impossibie to make any estimate of what the damages would be with the information available.

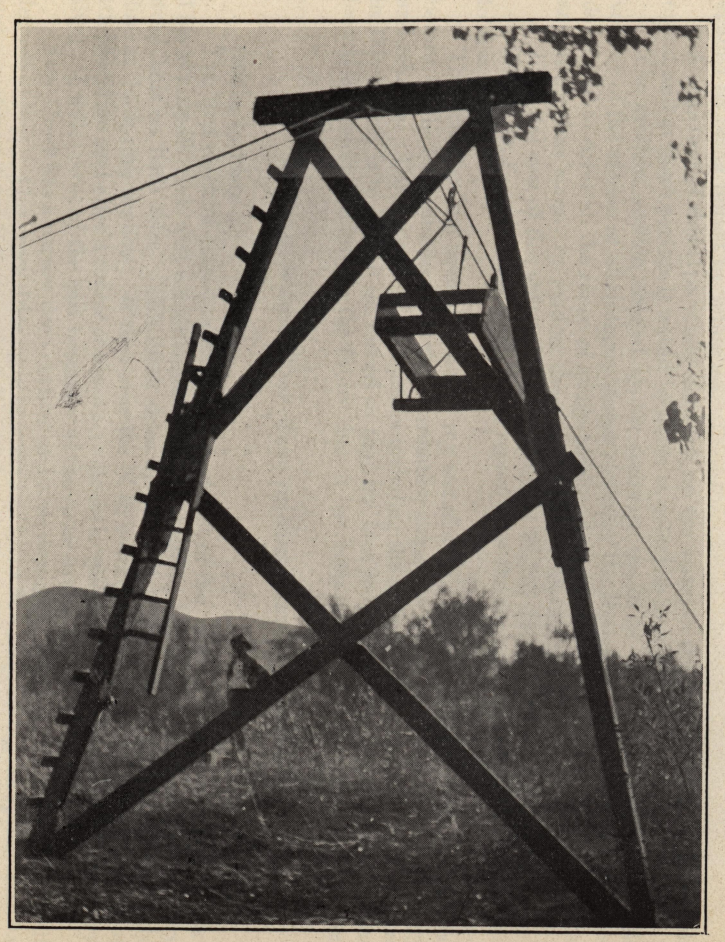
One point can be stated with certainty, and that is that while at present the river is fordable during the summer months at almost any place, with the additional amount of water proposed this would not be the case, and it would be necessary to erect highway bridges across the river at several places.

Table C attached to this report has been computed in an attempt to show approximately the capacity of the river channel at all the permanent stations along its course. The table explains itself but, in referring to it, it must be remembered that all the permanent stations were erected at picked cross-sections where the banks were high, and therefore the computations for "bank full discharges" using these sections, give results with considerably higher discharges than the average cross section of the stream would carry in the respective localities.

Proposed permanent section structure.

It has already been stated in this report that the sections used were all found to have shifting bottoms and that this condition is accentuated as one follows the river down stream from the western crossing of the north branch to the Eastern crossing, and it was pointed out that this condition makes it necessary that gaugings be made at very close intervals in

PLATE No. 25.



Left Frame at Spencer's Lower Ranche in position. Height, 22 feet.

PLATE No. 26.

Left frame at Pendant d'Oreille. Height 17 feet.

order to be able to plot an accurate discharge curve to cover a season's work. It is also propable that, owing to this same condition, the sections on the river will vary so much from season to season that a station rating curve developed from one season's work will be of little value for estimating discharges from gauge heights recorded during any succeeding season, which means that during all the years that information is required of the discharge of the river, gaugings at close intervals must be kept up continually.

There are also certain evidences, as already noted, to show that the Milk River has a considerable sub-surface flow and that this flow at certain stations is brought up to the bed of the stream where it is measurable, while at other stations it flows below the bed of the stream and is not measureable. It is thought that this flow is never far below the bed of the stream and it would be desirable to be able to measure this sub-surface flow at all stations.

It is thought that perhaps the best way to overcome these difficulties, and to prepare the river so that reliable information regarding discharges can be easily obtained in future years, would be to establish permanent sections along the river by artificial means.

Plate 6 attached to this report, shows a plan of proposed structure for establishing a permanent section station at Spencer's lower ranche.

The section at Spencer's lower ranche was used because it is typical of the conditions existing along the river and also because, having the greatest width of any section used and being the most difficult point at which to obtain materials, the estimate of the cost of this structure shows the maximum cost of establishing a structure of this kind at any point on the river. This plan is not intended to be a final plan nor have the minor details of construction been closely looked into, but it merely shows the type of structure which the writer thinks would be practicable. The idea kept in mind in designing this structure was to create a permanent section where all the sub-surface flow would be brought to the surface and to have the floor of sufficient width and with a sufficient depth of water flowing over it to admit of the use of a current meter. It would be necessary to establish these structures at points on the stream where the slope of the stream below the structure would be sufficient to ensure against its being buried by silting up.

A structure of this type would not back up the water in the stream to any appreciable extent and at flood periods it would be liable to complete immersion.

The artificial section created by the structure would be designed to carry the whole volume of the stream at all ordinary stages and after the station rating curve had been once developed to cover all the range of gauge heights, accurate discharges could be estimated at any future time simply by reading the gauge height at the section.

The total cost of this structure is estimated at $3,343.15.

Tables D, E, and F, attached to this report show the several items which constitute this total in detail.

The writer has not been able to find any record of this type of structure having been used before, but he feels confident that the information gained by its use would be very satisfactory and reliable. The writer's main object in including the discussion of this proposed structure in this report, is to have it on record so that the idea may be kept in mind and its merits looked into more carefully in the future than it has been possible to do at the present time.

Reconnaissance Trip East of the Eastern Crossing.

(Refer to Plate 1.)

The first creek of considerable size crossed east of the eastern crossing is Lost Creek. This is a small creek with a wide shallow channel running in a well defined valley with very steep hills on both sides. This creek dries up completely in summer and has a flow only during the spring freshets. It rises near the N.E. corner of Township 1, Range 4, West of 4th Meridian and after a course of about six miles in length crosses the international boundary about 1½ miles west of the east boundary of the same township.

Sage Creek has a narrow deep channel and runs through a level country without any well defined valley. This creek dries up in summer and has a flow only during the spring freshets and sometimes a small flow in the fall. It rises in Township 3, Range 3, West of the 4th

Meridian and after a course of about 19 miles as the crow flies, crosses the international boundary in Section 3, Township 1, Range 2, West 4th Meridian. After crossing the international boundary this creek runs into a dry lake bed of considerable size and as far as could be discovered has no outlet from it. This creek was equipped for stream measurement at a point directly east of Wild Horse Post, R.N.W.M.P. A gauge rod was erected and a measuring wire stretched across the stream. Plate 28 shows a view of this station. Wild Horse Post is 19 miles by trail from Spencer's lower ranch.

Lodge Creek was visited at Willow Creek Post, R.N.W.M.P., which is 25 miles by trail from Wild Horse Post. From high water marks seen at this point this creek is subject to a very large discharge in the spring freshets but its flow ceases during the dry season at this point. The fact that it has no flow during the dry season is no doubt due in part to the fact that the water is used further up stream for irrigation purposes. This creek has a watershed of considerable extent, but as the reconnaissance did not cover this territory it cannot be discussed. The cross-section of the creek was developed at a point near Willow Creek Post where the cross-section was suitable for the future erection of a permanent gauging station.

Battle Creek was visited at Sterling's farm, which is located in the south-east quarter of Section 22, Township 3, Range 27, West of the 3rd Meridian, and is distant 20 miles by trail from Willow Creek Post. At this point a temporary gauge rod was set, a metering taken, and the cross-section developed at a suitable place for the future erection of a permanent gauging station. This stream was visited on August 12, and, at the point noted above, had on this date a flow of 13 cu.ft. per second. This stream has a large area of watershed and from evidences of high water marks it is not subject to very excessive freshet discharge. It has a well defined channel, but runs through fairly level country in townships 1, 2 and 3 and is not contained by any well defined valley. This stream is the most important of any of those visited on this part of the trip, but no sufficient reconnaissance of it was made to allow of further discussion at this time.

Gauging Station on Sage Creek, near Wild Horse, R.N.W.M.P.

MILK RIVER, Alberta. Daily discharge sheet for July, 1909.

JULY. — Day of Month.	North Branch. Peters Ranche. 13-1-23-4.		North Branch. Knights Ranche. 13-2-21-4.		North Branch. Mackies Ranche. 19-2-18-4.		Combined North and South Branch Mackies Ranche. 23-2-18-4.		Milk River Station. 28-2-16-4.		Writing on Stone. 35-1-13-4.		Pendant d'Oreille. 16-2-8-4.		Spencers Lower Ranche. 3-1-5-4.	
	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.
1	.....	.....	.....	.....	.....	.....	.....	.....	2.	289	.....	.....	.....	.....	.....	.....
2	.....	.....	.....	.....	.....	.....	.....	.....	1.93	258	.....	.....	.....	.....	.....	.....
3	.....	.....	.....	.....	.....	.....	.....	.....	1.86	248	.....	.....	.....	.....	.....	.....
4	.....	.....	.....	.....	.....	.....	.....	.....	1.85	246.6	.....	.....	.....	.....	.....	.....
5	.....	.....	.....	.....	.....	.....	.....	.....	1.89	256	.....	.....	.....	.....	.....	.....
6	.....	.....	.....	.....	.....	.....	.....	.....	1.90	260	.....	.....	.....	.....	.....	.....
7	.....	.....	.....	.....	.....	.....	.....	.....	1.98	282	.....	.....	.....	.....	.....	.....
8	.....	.....	.....	.....	2.52	110	.....	411	2.43	428	.....	.....	.....	.....	.....	.....
9	.....	.....	.....	.....	2.48	104	.....	360	2.20	346	.....	.....	.....	.....	.....	.....
10	.....	.....	.....	.....	2.44	98	.....	318	1.95	274	.....	.....	.....	.....	.....	.....
11	.....	.....	.....	.....	2.40	91	.....	267	1.90	260	.....	.....	.....	.....	.....	.....
12	.....	.....	.....	.....	2.36	85	.....	226	1.82	238	.....	.....	.....	.....	.....	.....
13	.....	.....	.....	.....	2.32	80	.....	191	1.72	210	.....	.....	.....	.....	.....	.....
14	.....	.....	.....	.....	2.28	75	.....	165	1.70	204	.....	.....	.....	.....	.....	.....
15	.....	.....	.....	.....	2.24	70	.....	151	1.63	186	.....	.....	.....	.....	.....	.....
16	.....	.....	.....	.....	2.23	69	.....	147	1.60	178	.....	.....	.....	.....	.....	.....
17	.....	.....	2.00	61.5	2.22	68	.....	146	1.53	158	.....	.....	.....	.....	.....	.....
18	.....	.....	2.00	61.5	2.21	67	.....	142	1.50	150	.....	.....	.....	.....	.....	.....
19	.....	.....	2.00	61.5	2.20	65	.....	135	1.46	140	.....	.....	.....	.....	.....	.....
20	.....	.....	2.00	61.5	2.20	65	.....	133	1.41	125	.....	.....	.....	.....	.....	.....
21	1.91	51	2.00	61.5	2.20	65	.....	131	1.40	122	.....	.....	.....	.....	.....	.....
22	1.90	50	2,00	61,5	2.20	65	.....	131	1.40	122	.....	.....	.....	.....	.....	.....
23	1.90	50	2.00	61.5	2.20	65	.....	130	1.40	122	.....	.....	.....	.....	.....	.....
24	1.82	42.5	2.00	61.5	2.20	65	.....	130	1.33	104	.....	.....	.....	.....	.....	.....
25	1.93	53	2.00	61.5	2.20	65	.....	132	1.30	96	.....	.....	.....	.....	.....	.....
26	2.70	177	2.06	68.5	2.20	65	.....	137	1.44	133	.....	.....	.....	.....	.....	.....
27	3.90	591	2.82	196	3.10	236	.....	388	1.80	232	.....	.....	.....	.....	.....	.....
28	3.90	591	3.44	398	4.00	559	.....	1,487	3.30	800	.....	.....	.....	.....	.....	.....
29	2.40	118	2.76	181	3.24	282	.....	1,602	4,24	1,344	.....	.....	.....	.....	.....	.....
30	2.25	94	2.30	96	3.20	268	.....	1,528	3.72	1,000	.....	.....	.....	.....	.....	.....
31	2.10	87	2.20	82	3.00	209	.....	1,285	2.44	464	.....	.....	.....	.....	.....	.....
Total	.....	1,904.5	.....	1,575.0	.....	2,991.0	.....	9,873.0	.....	9,275.6	.....	.....	.....	.....	.....	.....
Mean	.....	173.14	.....	105.0	.....	124.6	.....	411.37	.....	299.21	.....	.....	.....	.....	.....	.....

MILK RIVER, ALBERTA. Daily discharge sheet for August, 1919.

AUGUST. — Day of Month.	NORTH BRANCH. Peters Ranche. 13-1-23-4.		Knights Ranche. 13-2-21-4.		Mackies Ranche. 19-2-18-4.		Combined North and South Branch Mackies Ranche. 23-2-18-4.		Milk River Station. 28-2-16-4.		Writing on Stone. 35-1-13-4.		Pendant d'Oreille. 16-2-8-4.		Spencers Lower Ranche 3-1-5-4.	
	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.
1	2.0	62	2.20	82	2.88	190	.....	903	2.18	370	.....	.....	.....	.....	.....	.....
2	2.0	62	2.20	82	2.76	155	.....	437	1.96	294	2.62	347	.....	.....	.....	.....
3	2.0	62	2.20	82	2.64	131	.....	283	1.82	250	2.44	300	.....	.....	.....	.....
4	2.0	62	2.20	82	2.52	110	.....	206	1.73	222	2.33	271	.....	.....	.....	.....
5	1.95	56	2.19	80	2.40	91	.....	171	1.63	192	2.23	245	3.02	249	.....	.....
6	1.95	56	2.15	75	2.28	75	.....	141	1.52	160	2.15	223	2.96	214	.....	.....
7	1.95	56	2.00	57.5	2.16	60	.....	134	1.50	152	2.11	213	2.90	190	.....	.....
8	1.95	56	2.00	57.5	2.08	52	.....	128	1.50	152	2.08	204	2.84	170	.....	.....
9	1.95	56	2.00	57.5	2.08	52	.....	121	1.50	152	2.04	194	2.81	163	2.88	194
10	1.95	56	2.00	57.5	2.08	52	.....	116	1.50	152	2.00	183	2.79	156	2.84	185
11	1.95	56	2.00	57.5	2.08	52	.....	113	1.46	140	1.96	170	2.75	146	2.80	176
12	1.95	56	2.00	57.5	2.08	52	.....	110	1.41	126	1.88	150	2.74	144	2.76	167
13	1.95	56	2.00	57.5	2.08	52	.....	106	1.40	122	1.91	159	2.73	141	2.72	159
14	1.95	56	2.00	57.5	2.08	52	.....	106	1.36	112	1.80	129	2.72	139	2.68	150
15	1.90	50	2.00	57.5	2.08	52	.....	98	1.31	98	1.78	122	2.63	121	2.64	141
16	1.90	50	2.00	57.5	2.08	52	.....	96	1.30	96	1.75	115	2.56	108	2.60	135
17	1.95	56	2.00	57.5	2.08	52	.....	96	1.30	96	1.73	110	2.54	105	2.56	124
18	1.95	56	2.00	57.5	2.08	52	.....	91	1.30	96	1.71	105	2.52	102	2.52	116
19	1.95	56	2.00	57.5	2.08	52	.....	90	1.30	96	1.69	99	2.50	100	2.48	108
20	1.95	56	2.00	57.5	2.08	52	.....	90	1.26	86	1.67	95	2.44	91	2.44	100
21	1.92	52	2.00	57.5	2.08	52	.....	90	1.25	83	1.65	90	2.44	91	2.40	93
22	1.90	50	2.00	57.5	2.08	52	.....	90	1.25	83	1.64	87	2.44	91	2.51	114
23	1.85	46	1.90	47	2.00	45	.....	83	1.21	76	1.63	84.6	2.43	90.5	2.63	139
24	1.85	46	1.90	47	2.00	45	.....	79	1.20	72	1.62	83	2.38	84	2.61	135
25	1.85	46	1.90	47	2.00	45	.....	79	1.20	72	1.62	83	2.38	84	2.58	128
26	1.85	46	1.90	47	2.00	45	.....	79	1.20	72	1.61	81	2.38	84	2.55	122
27	1.85	46	1.90	47	2.00	45	.....	79	1.20	72	1.60	80	2.36	82	2.52	116
28	1.85	46	1.90	47	2.00	45	.....	79	1.20	72	1.61	81	2.35	81	2.49	110
29	1.85	46	1.90	47	2.00	45	.....	77	1.20	72	1.60	80	2.37	83	2.47	106

30	1.85	46	1.90	47	2.00	45	.....	76	1.20	72	1.61	81	2.37	83	2.44	100
31	1.85	46	1.90	47	2.00	45	.....	76	1.24	82	1.63	84.6	2.38	84	2.41	95
Total	.....	1,648	.....	1,826.0	.....	1,997.0	.....	4,523.0	.....	3,992	.....	4,349.2	.....	3,276.5	.....	3,011
Mean	.....	53.16	.....	58.9	.....	64.4	.....	145.9	.....	128.77	.....	144.97	.....	121.35	.....	130.9
Diff	.....	.....	+5.74	.....	+5.5	.....	+81.5	.....	−17.1	.....	+16.2	.....	−23.6	.....	+9.6	.....

MILK RIVER, ALBERTA. Daily discharge sheet for September, 1909.

SEPTEMBER. — Day of Month.	North Branch. Peters Ranche. 13-1-23-4.		North Branch. Knights Ranche. 13-2-21-4.		North Branch. Mackies Ranche. 19-2-18-4.		Combined North and South Branch Mackies Ranche. 23-2-18-4.		Milk River Station. 28-2-16-4.		Writing on Stone. 35-1-13-4.		Pendant d'Oreille. 16-2-8-4.		Spencers Lower Ranche. 3-1-5-4.	
	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.
1	1.85	46	1.90	47	2.00	45	.....	79	1.25	83	1.62	83	2.39	85.5	2.39	91
2	1.85	46	1.90	47	2.00	45	.....	79	1.25	83	1.63	84.6	2.39	85.5	2.36	86
3	1.85	46	1.90	47	2.00	45	.....	79	1.25	83	1.63	84.6	2.38	84	2.33	81
4	1.85	46	1.90	47	2.00	45	.....	79	1.25	83	1.63	84.6	2.37	83	2.30	76
5	1.85	46	1.90	47	2.00	45	.....	83	1.25	83	1.63	84.6	2.38	84	2.30	76
6	1.85	46	1.80	38.5	2.00	45	.....	83	1.25	83	1.63	84.6	2.39	85.5	2.30	76
7	1.85	46	1.80	38.5	2.00	45	.....	83	1.25	83	1.65	89.4	2.38	84	2.30	76
8	1.85	46	1.80	38.5	2.00	45	.....	83	1.21	76	1.66	91	2.37	83	2.30	76
9	1.85	46	1.80	38.5	2.00	45	.....	83	1.16	65	1.64	85	2.38	81	2.30	76
10	1.85	46	1.80	38.5	2.00	45	.....	83	1.11	58	1.62	78.6	2.38	78	2.30	76
11	1.85	46	1.80	38.5	2.00	45	.....	83	1.10	56	1.59	70	2.38	76	2.30	76
12	1.85	46	1.80	38.5	2.00	45	.....	83	1.10	56	1.59	69	2.39	74	2.30	76
13	1.85	46	1.80	38.5	2.00	45	.....	83	1.17	66	1.61	73.4	2.38	70	2.32	79.5
14	1.85	46	1.80	38.5	2.00	45	.....	83	1.24	82	1.62	75.2	2.38	67	2.34	82
15	1.85	46	1.80	38.5	2.00	45	.....	83	1.29	93	1.64	79.8	2.40	66	2.27	71
16	1.85	50	1.80	42	2.00	45	.....	83	1.20	96	1.65	81.8	2.44	69	2.20	60
17	1.85	50	1.80	42	2.00	45	.....	83	1.26	86	1.67	86.4	2.48	71.7	2.19	58.6
18	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.67	85.4	2.52	75	2.23	65
19	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.66	82	2.50	75	2.30	76
20	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.66	81.8	2.49	72.5	2.30	76
21	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.66	80.2	2.46	70	2.30	76
22	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.66	79.4	2.46	70	2.25	67
23	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.66	78.4	2.47	71	2.25	67
24	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.69	85.8	2.49	72.5	2.27	71
25	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.69	85.0	2.50	73	2.27*	71
26	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.68	81.4	2.50	73	2.06†	75.5
27	1.85	50	1.80	42	2.00	45	.....	83	1.25	83	1.68	80.6	2.51	74	2.06	75.5
28	1.85	50	1.80	42	2.00	45	.....	83	1.21	76	1.68	79.8	2.50	73	2.04	73

29	1.85	50	1.80	42	2.00	45	.....	83	1.20	72	1.67	76.2	2.49	72.5	1.88	60
30	1.85	50	1.80	42	2.00	45	.....	83	1.16	65	1.67	75.4	2.48	71.5	1.87	59.5
Total	.....	1,440	.....	1,250	.....	1,350	.....	2,474	.....	2,358	.....	2,437	.....	2,268.2	.....	2,205.6
Mean	.....	48	.....	41.66	.....	45	.....	82.46	.....	78	.....	81.23	.....	75.6	.....	73.5
Diff.	.....	.....	−6.4	.....	+3.4	.....	+37.4	.....	−4.4	.....	+3.2	.....	−5.6	.....	−2.1	.....

*Upper gauge heights. †Lower gauge heights.

MILK RIVER, ALBERTA. Daily discharge sheet for October, 1909.

October. — Day of Month.	North Branch. Peters Ranche. 13-1-23-4.		North Branch. Knights Ranche. 13-2-21-4.		North Branch. Mackies Ranche. 19-2-18-4.		Combined North and South Branch Mackies Ranche. 23-2-18-4.		Milk River Station. 28-2-16-4.		Writing on Stone. 35-1-13-4.		Pendant d'Oreille. 16-2-8-4.		Spencers Lower Ranche. 3-1-5-4.	
	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.
1	1.85	50	1.90	51.5	2.11	55	.....	91	1.15	64	1.66	72	2.47	71	1.86	59
2	1.85	50	1.90	51.5	2.11	55	.....	87	1.10	56	1.66	73	2.47	71.2	1.87	59.5
3	1.85	50	1.90	51.5	2.11	55	.....	87	1.10	56	1.66	73	2.47	71.4	1.87	59.5
4	1.85	50	1.90	51.5	2.11	55	.....	86	1.10	56	1.67	74.5	2.48	73.3	1.87	59.5
5	1.85	50	1.90	51.5	2.11	55	.....	86	1.10	56	1.67	74.5	2.50	77	1.90	62
6	1.85	50	1.90	51.5	2.11	55	.....	86	1.10	56	1.66	73	2.50	77.2	1.88	60
7	1.85	50	1.90	51.5	2.11	55	.....	86	1.14	62	1.65	71.5	2.50	77.4	1.89	61
8	1.85	50	1.90	51.5	2.11	55	.....	86.5	1.15	63	1.65	71.5	2.50	77.8	1.94	64.5
9	1.85	50	1.90	51.5	2.11	55	.....	86.5	1.15	63	1.65	71.5	2.51	79	1.94	64.5
10	1.85	50	1.90	51.5	2.11	55	.....	87	1.19	70	1.66	73.0	2.50	79	1.94	64.5
11	1.85	50	1.90	51.5	2.11	55	.....	87	1.20	72	1.67	74.5	2.51	79.4	2.08	77
12	1.85	50	1.90	51.5	2.11	55	.....	87.5	1.20	72	1.67	74.5	2.52	82.9	2.07	76
13	1.85	50	1.90	51.5	2.11	55	.....	87.5	1.20	72	1.67	74.5	2.53	84.8	2.06	75.5
14	1.85	50	1.90	51.5	2.11	55	.....	88	1.25	82	1.67	74.5	2.51	82	1.94	64.5
15	1.85	50	1.90	51.5	2.11	55	.....	88	1.25	80	1.68	78.0	2.52	83.9	1.94	64.5
16	1.85	50	1.90	51.5	2.11	55	.....	89	1.25	80	1.69	80.0	2.54	87.6	2.02	71.5
17	1.85	50	1.90	51.5	2.11	55	.....	89	1.25	80	1.69	80	2.54	87.7	2.02	71.5
18	1.85	50	1.90	51.5	2.11	55	.....	90	1.25	80	1.68	78	2.54	88.1	2.12	80
19	1.85	50	1.90	51.5	2.11	55	.....	90	1.25	80	1.65	71.5	2.54	88.5	2.12	80
20	1.85	50	1.90	51.5	2.11	55	.....	91	1.25	80	1.62	67	2.54	88.9	2.12	80
21	1.85	50	1.90	51.5	2.11	55	.....	91	1.25	77	1.69	80	2.54	89.2	2.12	80
22	1.85	50	1.90	51.5	2.11	55	.....	92	1.25	77	1.70	82.5	2.55	91	2.12	80
23	1.85	50	1.90	51.5	2.11	55	.....	92	1.29	87	1.70	82.5	2.55	91.4	2.14	81.5
24	1.85	50	1.90	51.5	2.11	55	.....	92.7	1.30	89	1.70	82.5	2.56	93	2.16	83
25	1.85	50	1.90	51.5	2.11	55	.....	92.7	1.26	79	1.71	85.4	2.56	93.8	2.18	85
26	1.85	50	1.90	51.5	2.11	55	.....	93.4	1.25	73	1.70	82.5	2.56	94.1	2.18	85
27	1.85	50	1.90	51.5	2.11	55	.....	93.4	1.25	73	1.70	82.5	2.55	93	2.18	85
28	1.85	50	1.90	51.5	2.11	55	.....	93.4	1.25	73	1.70	82.5	2.54	92	2.18	85
29	1.85	50	1.90	51.5	2.1	55	.....	93.4	1.25	73	1.71	85.4	2.54	92.4	2.18	85

30	1.85	50	1.90	51.5	2.11	55	.....	93.4	1.25	73	1.72	88	2.54	92.7	2.19	85.5
31	1.85	50	1.90	51.5	2.11	55	.....	93.4	1.25	73	1.74	94	2.53	91.7	2.18	85.5
Total	.....	1,550	.....	1,596.5	.....	1,705	.....	2,776.8	.....	2,224	.....	2,407.8	.....	2,624.4	.....	2275
Mean	.....	50	.....	51.5	.....	55	.....	89.57	.....	71.74	.....	77.64	.....	84.6	.....	73.39
Diff	.....	.....	+1.5	.....	+3.5	.....	+34.57	.....	=17.83	.....	+5.9	.....	+6.1	.....	−11.3	.....

MILK RIVER, ALBERTA. Daily discharge sheet for November, 1909.

NOVEMBER. — Day of Month.	North Branch. Peters Ranche. 13-1-23-4.		North Branch. Knights Ranche. 13-2-21-4.		North Branch. Mackies Ranche. 19-2-18-4.		Combined North and South Branch Mackies Ranche. 23-2-18-4.		Milk River Station. 28-2-16-4.		Writing on Stone. 35-1-13-4.		Pendant d'Oreille. 16-2-8-4.		Spencers Lower Ranche. 3-1-5-4.	
	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.	G.H.	Disch.
1	1.85	50	1.90	43	2.15	60	.....	.....	1.25	70	1.73	90.2	2.52	90.6	2.19	85.5
2	1.85	50	1.90	43	2.15	60	.....	.....	1.25	70	1.73	90.2	2.52	91	2.20	86.5
3	1.85	50	1.90	43	2.15	60	.....	.....	1.25	70	1.73	90.2	2.51	89.8	2.18	85
4	1.85	50	1.90	43	2.15	60	.....	.....	1.25	70	1.73	90.2	2.52	91.6	2.18	85
5	1.85	50	1.90	43	2.15	60	.....	.....	1.25	67	1.73	90.2	2.53	93.6	2.16	83
6	1.85	50	1.90	43	2.15	60	.....	.....	1.29	77	1.73	90.2	2.51	90.6	2.18	85
7	1.85	50	1.90	43	2.15	60	.....	.....	1.30	80	1.77	100	2.46	84	2.16	83
8	1.85	50	1.90	43	2.15	60	.....	.....	1.30	80	1.89	132	2.69	119	2.18	85
9	1.85	50	1.90	43	2.15	60	.....	.....	1.40	108	1.88	130	2.70	120	2.20	86.5
10	1.85	50	1.90	43	2.15	60	.....	.....	1.40	108	1.88	130	2.69	119	2.18	85
11	1.85	50	2.00	53.6	2.15	60	.....	.....	1.40	108	1.86	124	2.70	120	2.16	83
12	1.85	50	2.00	53.6	.....	.....	.....	.....	1.60	166	1.85	122	2.72	124	.....	.....
13	1.90	54	2.00	53.6	.....	.....	.....	.....	1.60	166	1.84	119	2.72	124	.....	.....
14	1.90	54	2.00	53.6	.....	.....	.....	.....	1.60	166	.....	.....	2.75	130	.....	.....
15	1.90	54	2.00	53.6	.....	.....	.....	.....	1.60	166	.....	.....	2.68	117	.....	.....
16	1.90	54	2.00	53.6	.....	.....	.....	.....	1.60	166	.....	.....	2.60	103	.....	.....
17	1.90	54	2.00	53.6	.....	.....	.....	.....	1.60	166	.....	.....	2.64	110	.....	.....
18	1.90	54	2.00	53.6	.....	.....	.....	.....	1.69	190	.....	.....	2.66	113	.....	.....
19	1.90	54	2.00	53.6	.....	.....	.....	.....	1.70	194	.....	.....	2.74	129	.....	.....
20	1.90	54	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	2.78	138	.....	.....
21	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
22	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	.....	2.00	53.6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
28	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

30																
31																
Total		1,032		1,287.6		660				2,288		1,398.2		2,197.2		932.5
Mean		51.6		45.67		60				120.4		107.55		109.86		84.77
Diff																

TABLE A.

. ε of permanent stations established on the Milk River, Alberta, 1909. With Controlling elements.

and location.	Distance from last station.	Type of station.	Height of supports.	Span of cable.	Banks liable to overflow at flood.	Fall from last station.	Average fall per mile.
	Miles. (From Internat. bound'y.)		Feet.	Feet.		Feet. (From Internat. bound'y.)	Feet.
Peters Ranche	.....	Cable car equipment, low water measuring wire.	R=10.0	140	Yes.	.....	15.91
13-1-23-4	4.33		L=10.0	.....	.....	68.90	.....
Knights Ranche	.....		R=0.0	179	Yes.	250.07	16.40
13-2-21-4	15.25		L=14.0	.....	.....	.....	.....
Mackies Ranche, North Br'h	.....		R=14.0	150	Yes.	289.36	14.72
19-2-18-4	19.64		L=14.0	.....	.....	.....	.....
Mackies Ranche, South Br'h	.....		R=16.0	200	Yes.	.....	.....
31-1-18-4	.....		L=12.5	.....	.....	.....	.....
Milk River	.....	Bridge station.	.....	.....	Yes.	152.35	7.07
28-2-16-4	21.52		.....	.....	.....	.....	.....
Writing-on-stone	.....	Cable car equipment, low water measuring wire.	R=18.2	250	Yes.	424.08	10.69
35-1-13-4	39.64		L=19-6	.....	.....	.....	.....
Pendant d'Oreille	.....		R=23	290	Yes.	146.14	3.66
16-2-8-4	39.86		L=17	.....	.....	.....	.....
Spencers Lower Ranche	.....		R=20	350	Yes.	125.57	3.73
3-1-5-4	33.66		L=22	.....	.....	.....	.....
To Eastern Crossing	5.08	.....	.....	.....	.....	15.64	3.08
Totals	178.98	.....	.....	.....	.....	1,472.11	.....

NOTE.—The distances along the river are measured along the courses of the traverse by L. E. Fontaine, D.L.S.

SOUTH BRANCH.—From International Boundary to the junction with the North Branch: distance, 20.02 miles Fall=293.76. Average fall per mile=14.67 feet.

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General view of Permanent Station at Mackie's Ranche on the North Branch.

TABLE B.

STUDY of conditions of run-off-watershed of the Milk River from its head waters to its eastern crossing from Canada: Sec. 3–1–5–W. of IV. For the period August 8 to October 31, 1909.

Station.	Area of Watershed—Square miles.						Run-off—Ac. ft.		Run-off per sq. mile. ac.-ft.	
	Additional to last station.			Total for station.			Additional to last station.	Total for station.	For additional area.	For total area.
	Canada.	U.S.A.	Total.	Canada.	U.S.A.	Total.				
Peters Ranche, 13–1–23–4	.....	.....	.....	18	91	109	.....	8,305	.....	76.19
Knights Ranche, 13–2–21–4	124	6	130	142	97	239	−226	8,079	0.00	33.80
Mackies Ranche, North Branch, 19–2–18–4	196	0	196	338	97	435	+226	8,305	1,15	19.30
Junction, North and South Branch, 23–2–18–4	68	390	458	406	487	893	+6,312	14,617	13.78	16.37
Milk River, 28–2–16–4	182	2	184	588	489	1,077	+1,168	13,449	0.00	12.48
Writing on Stone, 35–1–13–4	414	129	543	1,002	618	1,620	+1,207	14,656	2.22	9.04
Pendant d'Oreille, 16–2–8–4	397	158	555	1,399	776	2,175	+91	14,565	0.00	6.69
Spencers Lower Ranche, 3–1–5–4	246	27	273	1,645	803	2,448	+291	14,856	1.07	6.06

TABLE C.

MILK River, Alberta. Study of conditions of flow showing the estimated capacity of the river channel with banks full.

Name and Location.	Distance from last station.	Average fall per mile.	Banks running full.						Character of river channel.
			Elements of X section.				Estimated.		
			Area.	R.	S.	C.	V.	Discharge.	
	Miles. (From International bound'y.)	Feet.	Sq. ft.				F.S.		
Peters Ranche, 13–1–23–4	4.33	15.91	246	4.577	.00301	51	6.069	1,434	Soft material liable to erosion. Clay-sand and sandy loam with outcrops of gumbo in spots.
Knights Ranche, 13–2–21–4	15.25	16.40	145	2.496	.00310	42	3.691	536	
Mackies Ranche, North Branch, 19–2–18–4	19.64	14.72	297	4.132	.00279	48	5.15	1,532	
Milk River, 28–2–16–4	21.52	7.07	515	3.636	.00134	47	3.280	1,690*	
Writing on Stone, 35–1–13–4	39.64	10.69	602	4.346	.00202	49	4.586	2,763	
Pendant d'Oreille, 16–2–8–4	39.86	3.66	1,456	7.142	.00069	54	3.791	5,519	
Spencers Lower Ranche, 3–1–5–4	33.66	3.73	1,700	5.71	.000706	53	3.360	5,712	

*Actual discharge measurement.

Method used in estimating Discharges.

Argument V = C.A.R.S.
"S" was derived from the average fall between stations.
Assuming "S" as above the value "N" = 0.40 was found to give correct results at Milk River, in comparison with actual measurements.
This value "N" = 0.40 was assumed for all stations.
The value of "C" was taken from tables in Trautwine's Engineer's Pocket Book.

TABLE E.

TIMBER and Iron bill.—Proposed structure for establishing permanent section station, Spencer's lower ranch.

Description.	—	Timber.			Iron.			
		B.M.	B. M.	Amount.	Iron spikes.	Weight.	Per lb.	Amount.
	Inches.		$ M.	$	Inche.s	Lbs.	Cts.	$
Main flooring	3x9	4,080	28	.....	.....	.....	.....	.....
Slope flooring	"	1,632	28	.....	6x½	326	5	16 30
Apron flooring	"	1,326	28	.....	7x½	930	5	46 50
Add for waste	"	306	28	.....	7x½	9	5	0 45
Centre wall	"	162	28	210 17	6x½	10	5	0 50
East end horizontal lining	1x12	140	25	.....	Wire nails.	5	5	0 25
West end horizontal lining	"	44	25	4 60	2½	.....	.....	.....
Sheet piling, double row along back	2x6	8,304	24	.....	Round.	.....	.....	.....
Sheet piling, east end, single row	"	448	24	.....	Wire.	.....	.....	.....
Sheet piling, east wing wall, single row	"	196	24	.....	6	.....	.....	.....
Sheet piling, west end, single row	"	320	24	.....	Spikes.	90	5	4 50
Add for waste	6x6	240	24	228 19	.....	10	5	0 50
Stringers for flooring	"	1,728	27	36 65	Drift bolts, round iron.			
" "	6x8	576	28	16 13	¾x18	323	5	16 15
Add for waste	6x6	192	27	.....	¾x18	22	5	1 10
Capping east end	"	150	27	.....	¾x18	53	5	2 65
Capping west end	"	84	27	11 50	¾x18	33	5	1 65
Piling—flooring	"	5,220	26	.....	.....	.....	.....	.....
" east buttress	"	1,008	26	161 93	.....	.....	.....	.....
" east brace piles	"	270	29	.....	.....	.....	.....	.....
" west buttress	"	450	29	20 88	.....	.....	.....	.....
Add for waste	"	360	26	9 36	.....	.....	.....	.....
Bracing east buttress	3x9	156	28	4 37	Spikes. 7x½	18	5	90
	.....	27,392	.....	703 78	.....	1,829	.....	91 45

TABLE D.

ESTIMATE of cost of proposed structure for establishing permanent section station at Spencer's lower ranche, Milk River, Alberta.

	$ c.
Timber—27,392 ft. b.m. delivered at Milk River station.....	703 78
Iron—1,829 lbs. delivered at Milk River station.....	91 45
Transportation—from Milk River station to Spencer's lower ranche (Table F.).....	720 00
Labour—Cost of labour (Table F.).....	1,324 00
Pile driver—Cost of, built on ground, 70 lb. hammer.....	100 00
Tools—cost of.....	100 00
Rip-rap—"one man stone" 668 sq. ft. Cost covered by expenses of team and driver.....	.....
	3,039 23
Exigencies—add for, 10 p.c.....	303 92
	3,343 15

TABLE F.

ESTIMATE SHEET—COST OF LABOUR.

	Per month.
1 foreman.....	$ 100
1 carpenter.....	75
3 labourers.....	150
1 teamster.....	50
1 cook.....	50
	$ 425

Time required: 2½ months.

Cost of labour.....	$ 1,062
Food for 7 men for 75 days at 50c. per day, per man.....	262
Total cost of labour.....	$ 1,324

It is assumed that the camp equipment, including team and wagon, will be supplied from the hydrographic surveys stores.

Transportation of Material to Spencer's Lower Ranche, from Milk River.

27,400 ft. b.m. taking 1,200 ft. b.m. per team load = 23 trips. 1,829 lb. iron = 1 trip. Total 24 trips. Each trip takes 6 days = 144 days. Team and driver at $5 per day.....	$720

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PLATE I.

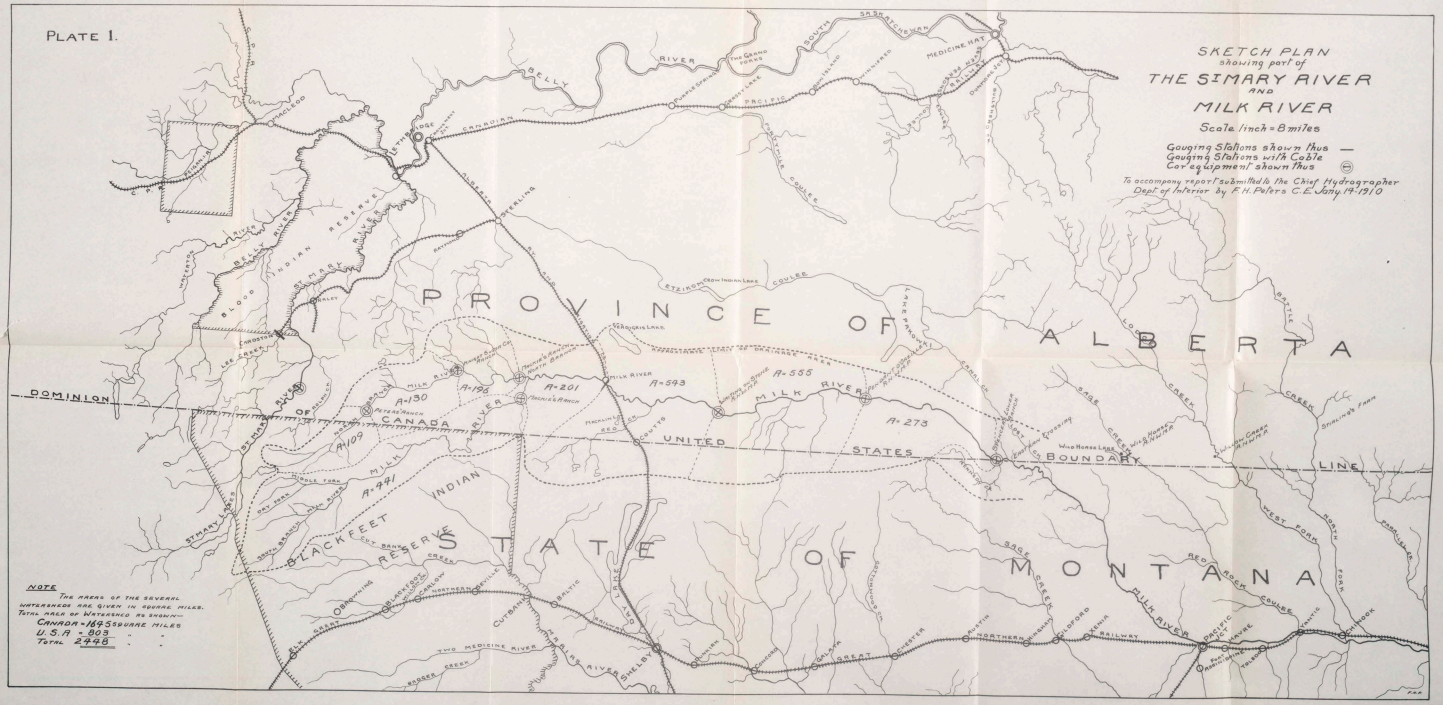
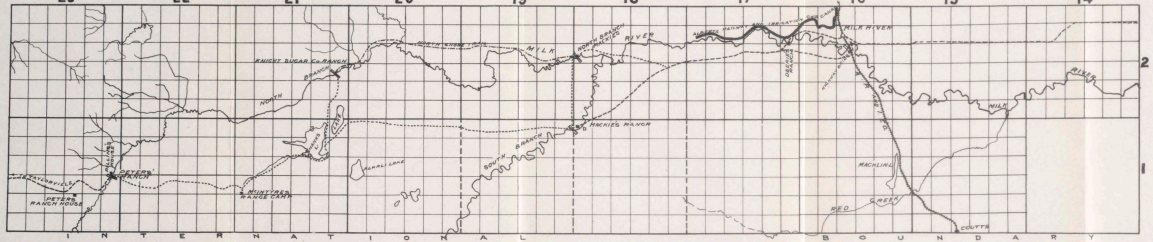
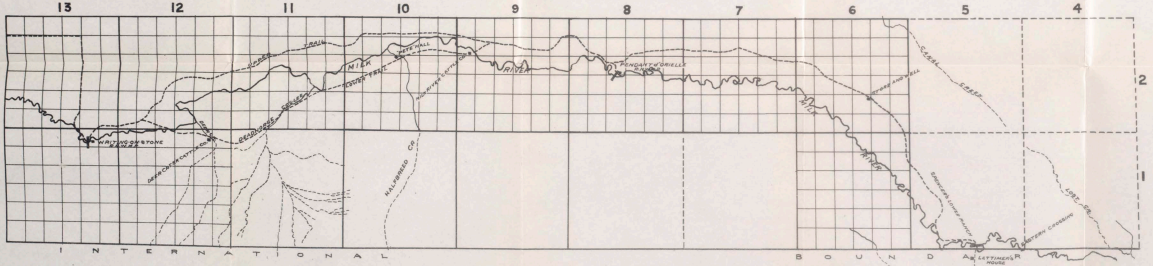

SKETCH PLAN
showing part of
THE ST MARY RIVER
AND
MILK RIVER
Scale 1 inch = 8 miles
Gauging Stations shown thus —
Gauging Stations with Cable Cor'equipment shown thus
To accompany report submitted to the Chief Hydrographer Dept of Interior by F. H. Peters C.E. July 14. 1910
PROVINCE OF ALBERTA
STATE OF MONTANA
DOMINION OF CANADA
UNITED STATES
BOUNDARY LINE
BLACKFEET INDIAN RESERVE
MILK RIVER
ST MARY RIVER
BELLY RIVER
SASKATCHEWAN
MEDICINE HAT
LETHBRIDGE
MACLEOD
CANADIAN PACIFIC
GREAT NORTHERN
A-130
A-196
A-201
A-543
A-555
A-273
A-441
A-109
NOTE
The areas of the several watersheds are given in square miles.
Total area of watershed as shown—
Canada = 169 square miles
U.S.A. = 803 "
Total 2448 "

PLATE 2.





SKETCH PLAN of MILK RIVER ALBERTA

SHOWING THE TRAILS USED BY THE HYDROGRAPHERS BETWEEN THE SEVERAL GAUGING STATIONS

TRAILS - WELL BEATEN - MUCH USED ----------
TRAILS - WELL BEATEN - LITTLE USED - - - - - - - - - - -
TRAILS - NOT WELL BEATEN - LITTLE USED .....

TO ACCOMPANY REPORT SUBMITTED TO THE CHIEF HYDROGRAPHER DEPT. OF INTERIOR BY F.H. PETERS. C.E. Jany 14-1909.

TABLE OF DISTANCES BY TRAIL

MILK RIVER TO MACKIE'S RANCH	17 MLS
MACKIE'S RANCH TO KNIGHT SUGAR Co. VIA NORTH SHORE	13 "
KNIGHT SUGAR Co. TO McINTYRE'S RANGE CAMP	14 "
MACKIE'S RANCH " "	22 "
McINTYRE'S RANGE CAMP TO PETER'S RANCH	10 "
MILK RIVER TO WRITING ON STONE	26 "
WRITING ON STONE TO PENDANT d'ORIELLE UPPER TRAIL / LOWER TRAIL	25 " / 35 "
PENDANT d'ORIELLE TO SPENCER'S LOWER RANCH	23 "
MILK RIVER TO PETER'S RANCH FOLLOWING ALL SIDE TRAILS	60 "
MILK RIVER TO SPENCER'S RANCH " "	90 "
TOTAL	150 "

L. J. G.

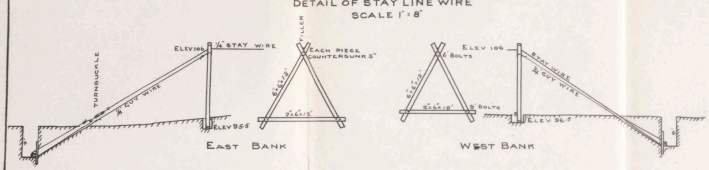
PLATE. 3.

MILK RIVER, ALBERTA
PLAN AND DETAILS OF CABLE CAR EQUIPMENT AT SPENCERS LOWER RANCH

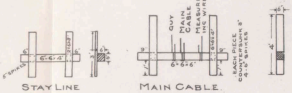
S.E. ¼ 3-1-5 WEST OF THE FOURTH MER.

TO ACCOMPANY REPORT SUBMITTED TO THE CHIEF HYDROGRAPHER DEPT. OF THE INTERIOR BY F. H. PETERS C.E. JANY. 14-1909.

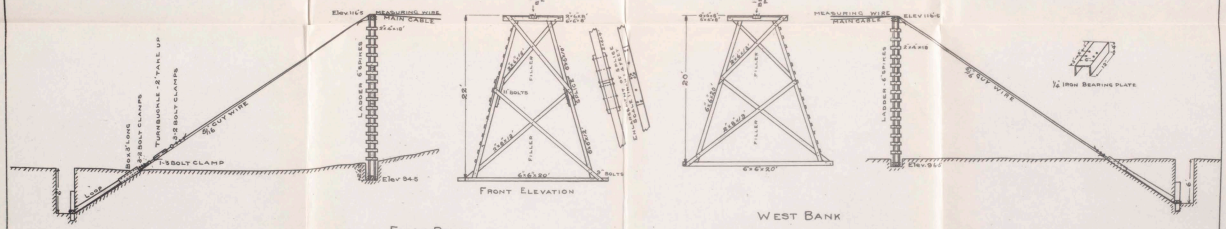
DETAIL OF STAY LINE WIRE
SCALE 1"=8'



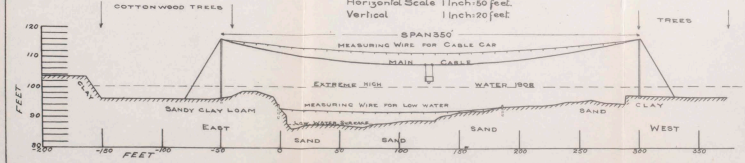
ENLARGEMENT OF DEADMEN
SCALE 1"=4'

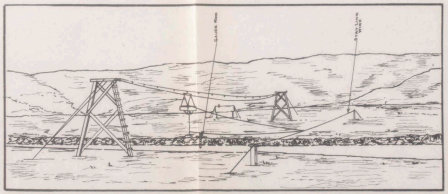


DETAIL OF MAIN CABLE EQUIPMENT
SCALE 1"=8'



SECTION ON ℄ OF GAUGING STATION
Horizontal Scale 1 Inch=50 feet.
Vertical 1 Inch=20 feet.





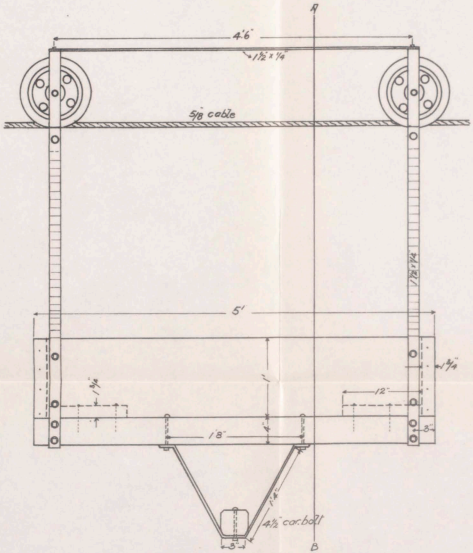
L. J. G.

PLATE 4.

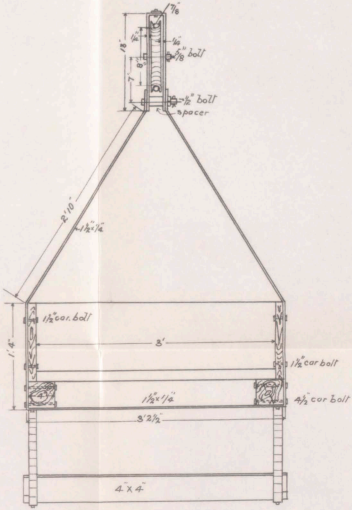
SIDE ELEVATION AND CROSS SECTION SHOWING DETAIL OF CABLE CAR

SCALE 1 INCH = 1 FOOT

TO ACCOMPANY REPORT SUBMITTED TO THE CHIEF HYDROGRAPHER DEPT OF INTERIOR BY F.H. PETERS C.E. Jany. 14-1909



SIDE ELEVATION



SECTION THROUGH A-B

L.J.G.

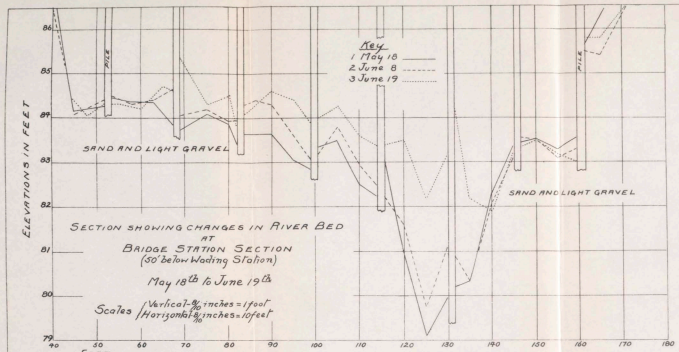
PLATE 5.

1909
MILK RIVER, ALBERTA

STUDY OF CONDITIONS OF RIVER CHANNEL AFFECTING DISCHARGE MEASUREMENTS AT MILK RIVER STATION

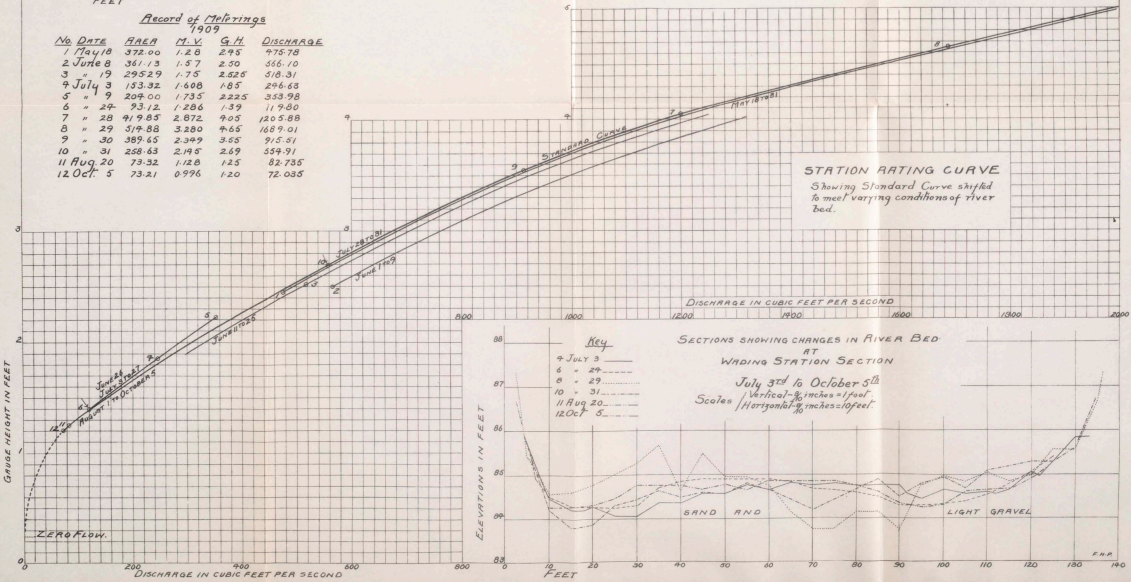
N.E. 21-2-16-W of 4th Meridian

To accompany report submitted to the Chief Hydrographer Dept. of Interior by F. H. Peters C.E. Jany. 19-1910.



Record of Meltings
1909

No.	Date	Area	M.V.	G.H.	Discharge
1	May 18	372.00	1.28	2.45	475.78
2	June 8	361.13	1.57	2.50	566.10
3	" 19	295.29	1.75	2.525	518.31
4	July 3	153.32	1.608	1.85	246.68
5	" 9	209.00	1.735	2.225	363.98
6	" 24	93.12	1.286	1.39	119.80
7	" 28	419.85	2.872	4.05	1205.88
8	" 29	519.88	3.280	4.65	1689.01
9	" 30	389.65	2.349	3.55	915.51
10	" 31	258.63	2.145	2.69	554.91
11	Aug. 20	73.32	1.128	1.25	82.735
12	Oct. 5	73.21	0.996	1.20	72.035



STATION RATING CURVE

Showing Standard Curve shifted to meet varying conditions of river bed.

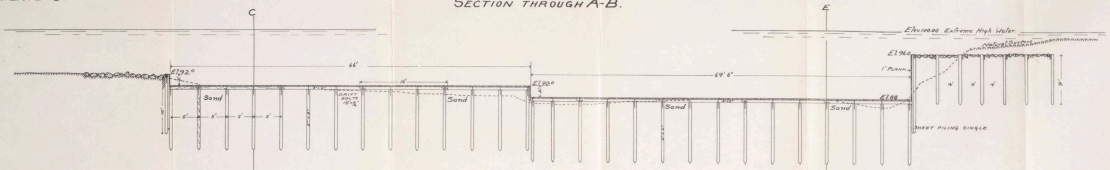
SECTIONS SHOWING CHANGES IN RIVER BED
AT
WADING STATION SECTION

July 3rd to October 5th

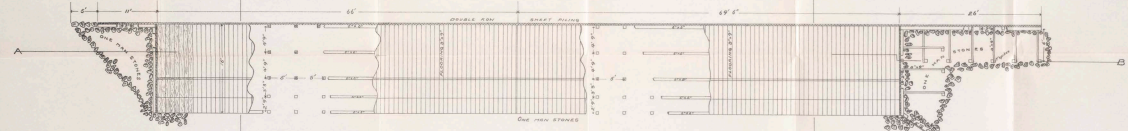
Scales Vertical 1/10 inches = 1 foot
Horizontal 1/10 inches = 10 feet

PLATE 6.

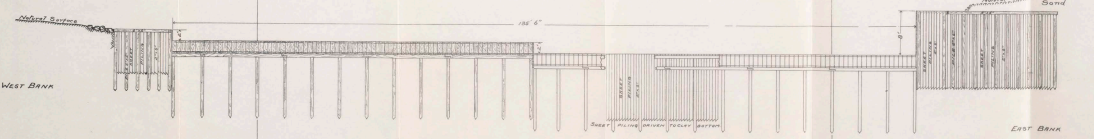
SECTION THROUGH A-B.

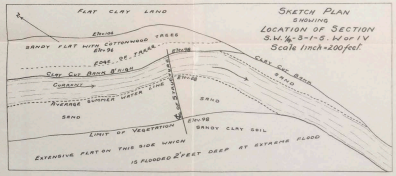


PLAN
Scale 1 inch = 8 feet

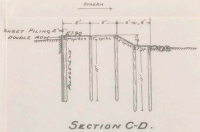


FRONT ELEVATION
GROUND REMOVED

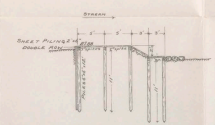




Sketch Plan showing Location of Section S.W. ¼ S.3 T.1 R.2 W of 1V
Scale 1 inch = 200 feet



SECTION C-D.



SECTION E-F.

PLAN
OF
PROPOSED STRUCTURE
FOR ESTABLISHING
PERMANENT SECTION STATION
AT
SPENCER'S LOWER RANCH
MILK RIVER, ALBERTA

Scale 1 inch = 8 feet

To accompany report submitted to the Chief Hydrographer Dept. of Interior by F. H. Peters C.E. Jany 19-1910

F.H.P.